DOCUMENT RESUME

ED 213 581 SE 036 094

AUTHOR Sly, Carolie; Rose, Larry
TITLE Environmental Education Guide, Volume 2: An Environmental/Energy Education Primer for Grades Four through Six, 1981-1984.
INSTITUTION Alameda County Superintendent of Schools, Hayward, Calif.; California State Dept. of Education, Sacramento.
PUB DATE 81
NOTE 273p.; For related documents, see SE 036 093-096. Contains colored print which may not reproduce well.
AVAILABLE FROM Office of the Alameda County Superintendent of Schools, 685 "A" St., Hayward, CA 94541 ($7.00; $25.00 for complete set of 4 volumes).

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Conservation Education; *Curriculum Development; Decision Making; Elementary Education; Elementary School Curriculum; Energy; Energy Conservation; *Environmental Education; Institutions; *Interdisciplinary Approach; Intermediate Grades; *Learning Activities; Natural Resources; Physical Environment; Urban Environment
IDENTIFIERS *California; *Energy Education; Environmental Management

ABSTRACT

As one of four volumes in a K-12 series, this teaching guide contains classroom and outdoor activities pertaining to the environment and energy for fourth through sixth grades. The guide was developed based upon the understanding that environmental education can serve as an instructional umbrella covering many topics (conservation, marine education, city planning, population, etc.) and that it is not a specific subject but an interdisciplinary theme. The activities are organized around four major topics: natural environment, built environment, social institutions and decision making, and energy and environmental resource management. Each section begins with a summary of issues related to that topic followed by a listing of major concepts and their associated objectives. One activity is presented to teach each objective (approximately 40). Objectives correspond with those contained in the California "Course of Study" guide for 1981-84. Each activity provides a brief description, the objective, purpose, time, topics, location, materials, lead-up and preparation procedures, and follow-up activities. Appendices list the sources for the activities, California resource agencies, and teaching materials available from these agencies. In the beginning of the guide, a procedure is outlined for planning an environmental education program. (DC)

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ENVIRONMENTAL EDUCATION GUIDE

SE 026 094

Environmental Education Guide
Volume 2

An Environmental/Energy Education Primer for Grades Four through Six 1981 - 1984

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In cooperation with the California State Department of Education
Wilson Riles, Superintendent of Public Instruction

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Joint Policy Statement
Environmental/Energy Education

California's abundant varied and productive natural resources coupled with a high degree of environmental quality have enabled our citizens to live highly rewarding and productive lives. Successful continuation of a high quality of life for us all depends upon how well we conserve, manage, and utilize energy and natural resources and safeguard our environment.

Wise resource and environmental management involves the intelligent cooperation of governmental resource management agencies, private industry, and concerned and informed citizens acting individually or through their elected and appointed officials.

Intelligent and effective citizen participation in resource and environmental conservation requires knowledge in a number of areas, including the sciences, social sciences, and humanities. It requires the development of skills which enable each person to live in a manner which supports environmental quality. It involves commitment to get involved and work for a better life for all Californians now and in the future.

Our schools play a key role in the development of what amounts to an informed public environment ethic.

Instruction must be provided at all grade levels and in all appropriate subject matter areas. Outdoor learning experiences should be provided and full use should be made of services, materials, and expertise offered by resource management agencies, citizen conservation associations, businesses, industries, and others. Teachers must understand the importance of their role in environmental education, possess the necessary knowledge and skills in this area of instruction, and be provided with adequate instructional materials and equipment.

The Department of Education and the Resources Agency share responsibility for encouraging the development and maintenance of an effective environmental/energy education program for the schools of California. In recognition of this responsibility, we, the Superintendent of Public Instruction and the Secretary for Resources, agree to provide appropriate services, materials, and expertise to the schools and to coordinate our efforts in a statewide program.

We further urge educators and resource management personnel at all levels to work together for the benefit of the most precious resource of all, the youth of California.

Wilson Riles
Superintendent of
Public Instruction

Huey D. Johnson
Secretary for Resources

Contents

	Page
Acknowledgments	1
Historical Development of the Guide	4
Introduction	6
Planning an Environmental Education Program	7
Classroom Activities	
Natural Environment	18
Built Environment	36
Social Institutions and Decision Making	52
Energy and Environmental Resource Management	74
Appendix	
Sources of Classroom Activities	93
California State Resource Agencies	97
California State Resource Agency Materials	127
Resident Outdoor Education Programs	137

ACKNOWLEDGMENTS

The project manager and staff would like to express their appreciation for the professional contributions of the many environmental educators throughout the state.

We owe an enormous debt to our colleagues whose assistance throughout the entire development of this curriculum guide made it possible to move to the next developmental phase. Each phase required a particular kind of expertise and the California environmental education community responded admirably. Rudy Schafer, Environmental/Energy Education Coordinator for the State Department of Education, provided the principal leadership for the development of this Guide. He worked very closely with us throughout the entire project, providing valuable environmental education curriculum materials from California, throughout the United States, and many foreign countries. His support and encouragement were most appreciated.

Esther Railton, Director of Environmental Education at California State University, Hayward, was the principal consultant for the development of the environmental education conceptual framework. Her background, reputation, and experience in environmental education were invaluable to the project team. Upon completion of the environmental education framework, a group of environmental educators from throughout the state were invited to a workshop at the Asilomar Conference Center for the review, critique, and modification of the suggested framework's goals (concepts) and objectives, which were developed under Dr. Railton's guidance. The following people participated at the Asilomar workshop:

Bill Baker
Alameda County Superintendent of Schools
Hayward

Dorothy Bjur
University of Southern California
Los Angeles

Edith Carlston
Pittsburg Unified School District
Pittsburg

Grant Cary
Laurel Ecology Center
Van Nuys

Cheryl Christiansen
Humboldt County Office of Education
Eureka

Jack Davidson, *Los Angeles County Superintendent of Schools*
Downey

Teresa DeBono
Alameda County Superintendent of Schools
Hayward

Bob Flasher
The Oakland Museum
Oakland

Ron Fontaine
Kern High School District
Bakersfield

John Harter
School of Education
University of California, Berkeley

Marlynn Kaake
Lincoln Middle School
Alameda

O. E. Leaf
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Sacramento

Nat Pearson
Alameda County Superintendent of Schools
Hayward

Gloria Refuerzo
Highlands School
Pittsburg

Robert Ryan
California State Department of Education
Sacramento

Rudy Schafer
California State Department of Education
Sacramento

Barbara Steinberg
Marin County Office of Education
San Rafael

Bruce Stewart
Moss Landing Marine Laboratory
Moss Landing

Vince Vandre
Department of Fish and Game
Sacramento

Debra Voss
Solid Waste Management Board
Sacramento

Randy West
La Vista High School
Orangevale

Molly Whitely
Napa Junction School
Napa

The next major task of the project team was to form a research team to review curriculum programs, guides, and materials from throughout the country to determine what environmental education activities matched the concepts and objectives of the environmental education framework. The following individuals tenaciously pursued this task until activities were matched to each objective of the framework:

Kathryn Slichter
Friends of the Earth
San Francisco

Carolie Sly
Environmental Education Consultant
Berkeley

Alice Watt, Research Assistant
California State University
Hayward

Abby Zurier
Environmental Education Consultant
Palm Springs

Teachers and curriculum experts from all over the state were then selected to review the activities the research team had chosen to determine the best and most appropriate activities for each of the environmental education objectives. There were four such workshops and the following people were involved:

Jeanette Biasotti
Rancho Romero School
Danville

Jerry Bishop
Castro Valley High School
Castro Valley

Lee Boyes
Egling Middle School
Colusa

Maxine Burnworth
Parkside School
Pittsburg

Edith Carlston
Pittsburg Unified School District
Pittsburg

Evelyn Cormier
Brookvale School
Fremont

Sam Dederian
Galileo High School
San Francisco

Linda DeLucchi
Lawrence Hall of Science
Berkeley

Gail Faber
Rancho Romero School
Danville

Bert Felton
Rancho Romero School
Danville

Joe Fontaine
Kern High School
Bakersfield

Phil Gordon
Rancho Arroyo Junior High School
Hayward

Joe Hamilton
New Haven Unified School District
Union City

Gary Heath
Lawrence Hall of Science
Berkeley

Toris Jaeger
Orinda Unified School District
Orinda

Marlynn Kaake
Lincoln Middle School
Alameda

Marcia Batcheller-Kallison
Piedmont Middle School
Piedmont

Margaret Kelley
Coyote Hills Regional Park
Fremont

Sylvia Kendzior
Rancho Arroyo School
Danville

Kathy King
Logan High School
Union City

Dallas LaBlanc
Southwood Junior High School
San Francisco

Carol Libby
Loma Vista School
Vallejo

Rich Lohman
Albany High School
Albany

Helen McKenna
Washington High School
San Francisco

Larry Malone
Lawrence Hall of Science
Berkeley

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Sacramento

Nancy Olson
Pittsburg Unified School District
Pittsburg

Erma Owens
Garfield School
Oakland

Lynne Porteous, *Fort Funston*
San Francisco Unified School District
San Francisco

Esther Railton
California State University
Hayward

Gloria Refuerzo
Highlands School
Pittsburg

Karen Reynolds
Oakland Unified School District
Oakland

Melva Rush
Thornton Junior High School
Fremont

Helga Schwab
Earhart School
Alameda

Marilyn Shaver
Bel Air School
Pittsburg

Phyllis Shuck
Olive School
Novato

Sylvia Smith
Pittsburg Unified School District
Pittsburg

Barbara Steinberg
Marin County Office of Education
San Rafael

Ray Watson
Walters Junior High School
Fremont

Randy West
La Vista High School
Orangevale

Molly Whiteley
Napa Junction School
Napa

Bev Wu
Lakeview School
Oakland

When the teacher workshops were completed, we discovered that there was a need to revise and adapt many of the activities to match the objectives more closely. In some cases, the teachers felt that none of the activities they had reviewed was appropriate or acceptable; this required developing original classroom activities. The majority of the writing was done by Larry Rose, San Francisco environmental and energy education consultant, and Carolie Sly. In addition, Carolie had the delicate responsibility of coordinating the efforts of the writing team. The following people also contributed to the writing efforts and to them we owe a debt of gratitude:

Bob Flasher
The Oakland Museum
Oakland

Gary Heath
Lawrence Hall of Science
Berkeley

Marcia Batcheller-Kallison
Piedmont Middle School
Piedmont

Larry Malone
Lawrence Hall of Science
Berkeley

Steve Wilkes
Anna Kirchgater School
Sacramento

Molly Whiteley
Napa Junction School
Napa

Randy West reviewed the California State Resource Agencies materials, selected those that were appropriate for classroom use, and matched those materials to the major areas of concern.

Without Shelle Bolar, Maycelle Elliott, Bonnie Halligan, Marie Perez, and Dorothy Vallerga — secretaries in the Instructional Support Services Unit — who spent endless hours typing this Guide, it never could have become a reality.

The drawings in this Guide are those of Louis LaBrie, Oakland artist. And finally, thanks to John O'Lague and his Publications Services staff, Douglas Arthur, Salvador Cortez, Linda Henderson, and Cindy Price, for editing, designing, and typesetting the Guide.

This Guide has truly been a cooperative effort by the environmental education community; we wish to express our appreciation to all.

August F. Scornaienchi

HISTORICAL DEVELOPMENT OF THE GUIDE

The modern environmental movement which began in the late 1960's has brought about major changes in the ways in which Americans relate to the land, its resources, and to each other. In the early 1970's, the term environmental education came into use as a means of describing an appropriate educational response to this new ethic.

In 1973, the California State Department of Education published a book entitled **Ekistics — A Guide for the Development of an Interdisciplinary Environmental Education Curriculum.** The publication was based on the work of Paul Brandwein, and specified learning experiences in three broad areas in which humans interact with the natural world: in the exchange of matter and energy, through social institutions, and through cultural components and forms. The publication is still in print and considered valuable by many.

In late 1978, a group of representatives of state resource management agencies and the education community got together to discuss environmental education in terms of what had been learned over the years since the development of **Ekistics**, through license plate grants, federal projects, resource agency programs, and other activities. As a result of this meeting, a new set of goals and objectives were developed, and these, in turn, were written into the 1979-81 county superintendents cooperative **Course of Study**.

In that publication, it was observed that environmental education had instructional implications in a number of discipline areas, and specific examples were pointed out in the various subject matter sections.

The resource agency-eduction committee, which had developed the new set of goals and objectives, felt that further work was needed to produce curriculum and supporting materials which would facilitate the infusion of environmental education into the entire K-12 instructional program. A recommendation to this effect was made to the Secretary for Resources who budgeted $150,000 from fiscal 1979-80 environmental license plate funds for this purpose.

After approval by the legislature, the Department of Education called a meeting of key educators including classroom teachers, administrators, teacher educators, resource management agency personnel, and others who reviewed currently available materials, developed a content outline, and otherwise spelled out in some detail what was needed, and how the final product should be organized. It was agreed that input from both educators and resource management personnel was important through every step of the developmental process, and that the emphasis should be on practicality and usability at all levels.

The Department of Education developed a contract based on the recommendations of this ad hoc advisory commitee, and the Alameda County Superintendent of Schools was the successful bidder.

This proved to be a fortunate choice for a number of reasons. The office had a competent staff of people to do the job, was in close contact with the Bay Area education community, and most important, had the contract to produce the 1981-84 **Course of Study**. This latter circumstance proved to be most fortunate because it enabled staff to develop the environmental education material in tandem with the **Course of Study**, with the result that what was produced became a component of an extension of this key state-level publication.

The guide is based on two major premises:

- Environmental education can serve as an instructional umbrella with a great number of topic areas such as energy and conservation, marine education, outdoor school programs, wildlife resources, soil conservation, historical and recreational resource management, city planning, population growth, nature study, and others, may be addressed in a holistic manner.

- That environmental knowledge, skills, and attitudes cut across all subject matter lines at all instructional levels, and, therefore, environmental education should be seen not as a specific and separate subject, but as a theme which should be infused throughout the instructional program at all levels.

In response to the wishes of the ad hoc advisory committee, the Guide has something of practical value for everyone. For curriculum developers and producers of materials, there is a K-12 curriculum outline. Classroom teachers will find nearly 200 sure-fire learning activities selected for their suitability by their colleagues, and access to hundreds more. Administrators will find a plan for getting an appropriate program underway in their schools, resource management agency people will be able to acquaint educators with information regarding their role in resource management, management problems and issues, and materials and services they can provide.

Although publication of this material represents an important milestone in environmental education in California, we must not fall into the trap of believing that the job is completed with its printing and distribution. What happens next in schools and classrooms throughout the state will be the real measure of success for this work, and we are looking to you for your help.

Rudolph J. H. Schafer, Director
Environmental Energy Education
California State Department of Education

INTRODUCTION

A Point of View

The primary goal of environmental education is to develop citizens who are knowledgeable about the environment and involved in working toward a more liveable future. This goal is based on the following assumptions:

- The environment is not only biophysical; it is also aesthetic, economic, social, and political as well.
- Environmental education must promote an environmental ethic where people are not exploiters of the environment but are stewards concerned with the perservation of all life systems.
- Environmental education must reflect a commitment to future generations, not merely perpetuate the values of the past.
- Environmental education is not a subject, but a synthesis of concepts and skills from all disciplines that relate to the environment.
- "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends to do otherwise." (Aldo Leopold)

Organization of the Environmental Education Guide

The purpose of this Guide is to provide teachers with background information, program structure, and activities for environmental education. The Guide actually consists of four volumes: K-3, 4-6, 7-9, and 10-12. Each volume is organized around four major content areas of concern:

1. Natural Environment
2. Built Environment
3. Social Institutions and Decision Making
4. Energy and Environmental Resource Management

These areas are addressed in the following ways:

Issues related to each area of concern are examined in an effort to provide educators with background information. While by no means definitive, these statements are starting points for understanding these complex issues.

A chart, **Matching Objectives to Classroom Activities**, states the instructional objectives under each area of concern and describes, in summary, related activities at the four levels (K-3, 4-6, 7-9, 10-12).

Classroom activities are samples of ways in which a teacher can address the instructional objectives. The activities integrate key stages of cognitive development. Instructional techniques are suggested that promote problem-solving skills, values, and attitudes consistent with our role as stewards of planet earth.

Guidelines for **Planning an Environmental Education Program** are for a principal or curriculum coordinator to follow as s/he helps a group of teachers plan their program.

The appendices give an overview of the California resource agencies. This clarifies the unique role of each agency and how the agencies fit together in a joint effort to manage our state's resources. A list of no-cost and low-cost teaching materials available from these resources is included in this section as well as a directory of California resident outdoor education programs.

PLANNING AN ENVIRONMENTAL EDUCATION PROGRAM

An Interdisciplinary Approach to Environmental Education

The purpose of the **Environmental Education Guide** is to help teachers promote better understanding of the diversities and interdependencies of life systems and nurture the skills involved in decision making. This requires a synthesis of concepts and skills that relate to the environment from **all** subject areas. Environmental education is not treated as a separate, discrete discipline, but as an integration of disciplines that results in new ways of thinking about and behaving toward our environment. We, as educators, are, therefore, faced with the challenge of looking at our curriculum in perhaps a new way — one which allows us to consider the entire curriculum as a system for organizing an environmental education program.

As we integrate concepts from environmental education into the curriculum, we face the danger of fostering a nonsequential, "shotgun" approach to program planning. We hope the Planning Chapter will help guide that process in a way that encourages an individual teacher or a staff to choose concepts, objectives, and activities that are related and built upon each other in a comprehensive sequence.

Overview of Environmental Education Planning

This section of the **Environmental Education Guide** is intended to provide schools with a set of procedures for developing an interdisciplinary environmental education program. These procedures are written primarily for the individual(s) responsible for assisting schools in developing an environmental education program. This may be the principal, a curriculum coordinator, resource specialist, or a teacher. The procedures guide a school staff as they:

- Reach agreement on a working definition of environmental education.
- Review their curriculum for the purpose of identifying current environmental education classroom or school activities.
- Adopt environmental education concepts to infuse into the selected curriculum areas.

- Identify the curriculum area(s) most appropriate for infusing environmental education activities.
- Select and implement environmental education classroom activities.
- Assess the effectiveness of their environmental education program.

These procedures may be followed by an entire staff, or by teachers from a selected department, grade level, or grade cluster (K-3, 4-6, 7-9, 10-12). The entire process can be carried out in approximately three 1½-hour sessions.

Finally, these recommended procedures are not conclusive statements on environmental education curriculum planning. They are intended as **suggestions** and have been successful guidelines for planning other curriculum areas. Also, these procedures are **starting points** for developing an interdisciplinary program; they by no means stand alone as a definitive method toward interdisciplinarity. As these procedures are tried out and revised, it is hoped a useful method will evolve.

Reaching Agreement on Environmental Education Point of View

Session I:	The staff agrees upon a working definition of environmental education, identifies environmental education activities they currently use, and selects major areas of concern to infuse into the curriculum.

The following procedures are designed to help a school faculty come up with a common working definition of environmental education:

- The group leader begins the first session by describing the purpose and the agenda of the session.
- The leader then distributes a copy of the Point-of-View statement from page 6 of the Guide. This statement serves as a starting

point for discussion, "How do we define environmental education?"

- The leader elicits reactions and modifications from the group as they examine the Point-of-View statement. If only minor changes are suggested, participants can note changes on their copies; if extensive changes are suggested, the group leader may want to record on the chalkboard or newsprint.
- The group then attempts to reach agreement on a common Point-of-View statement which reflects their modifications. The leader may facilitate agreement by using a consensus or straw-vote process. (See the Process Glossary for explanations.)

Now that the group has a working definition of environmental education, they are ready to identify elements of environmental education in their existing curriculum.

- The group leader asks each individual to jot down those learning activities that s/he has done, is doing, or plans to do with students that relate to environmental education. These should be noted as briefly as possible, perhaps by title or a short, descriptive phrase.
- As the participants note activities, the group leader places four pieces of newsprint on the wall. Each piece is titled with one of the areas of concern from the Guide: Natural Environment, Built Environment, Social Institutions and Decision Making, and Resource Management.
- After approximately five minutes, the leader asks the group to stop writing and distributes Issues statements of each area of concern (see Guide, pages 19, 37, 53, and 75). These statements will help guide the group as they categorize their activities.
- The leader asks individuals to call out their activities and identify the area of concern that each activity best fits. The leader records responses on the appropriate pieces of newsprint.

The group has compiled a record of ways in which it already teaches about the four areas of concern, as they consider ways to further emphasize environmental education in their curriculum.

- The leader facilitates a discussion of the four areas of concern referring to the Issues statements, as well as the activities listed under each heading.
- The leader distributes Summary of Activities sheets (see pages 21, 39, 57, and 77) and assists the group as they examine the concepts, the objectives, and the activity descriptions under each area of concern.
- After discussion and clarification, the leader asks the group to reconsider its curriculum and determine which of the areas of concern it would like to emphasize in the future. Some members of the group may wish to strengthen or expand on an idea already emphasized; others may wish to tackle a new idea. The leader encourages debate (see debate in the Process Glossary).
- The leader helps the group agree upon which areas it will infuse into the curriculum. This is to be a group decision — the leader may want to use a consensus or rank ordering process to assist the group (see consensus or rank order in the Process Glossary).

The group has now agreed upon a common Point-of-View statement to use as a working definition of environmental education. It has identified currently used curriculum activities, and has also identified the areas of concern it will address in the curriculum.

Selecting Concepts for Your Curriculum

> Session II: The group modifies and selects the concepts under each area of concern that will be infused into the curriculum. Each participant agrees to teach two or three concepts and report back to the group.

The following procedure guides the group as they modify concepts for each selected area of concern:

- The leader describes the purpose and agenda of the session.
- The group forms teams of four to six members. Each team meets around a table (see working in groups of four to six in Process Glossary). Each member has a copy of the Summary of Activities sheet for each of the areas of concern to be infused into the curriculum.

- The leader asks all teams to review concepts, objectives, and activity descriptions for all selected area(s). The leader moves from group to group so that participants have the opportunity to ask questions of clarification.
- The leader then assists the teams as they consider modifications and/or additions.
- After approximately 15 minutes, the leader calls the group back together and elicits proposed changes. These suggestions are recorded on the chalkboard or recorded on newsprint; the leader then helps the group agree on final modifications and/or additions, if any (see consensus or rank order in Process Glossary).

The group now has a satisfactory set of concepts and will select specific concepts to emphasize in their curriculum. They may choose one or several concepts listed under each selected area.

- The group discusses which concepts are most appropriate for its curriculum. They may consider the ages and interests of their students, time constraints they foresee, their own interests and abilities, and the availability of related resources.
- Participants are encouraged to advocate for specific concepts they may think should be included in the curriculum (see advocacy in the Process Glossary).
- After the discussion and advocacy period is over, the leader helps the group reach agreement on which concepts they will include in their curriculum. Once again, the consensus or rank order process may be useful (see Process Glossary).
- This process is repeated for each area of concern the staff has selected.

The group now has a clear picture of the area of concern and related concepts it will infuse into the curriculum. It is now ready to make personal commitments to implement related concepts.

- The group leader prepares the following matrix on the chalkboard or newsprint:

MATRIX I: CHART FOR ELEMENTARY

Teachers' Names and Grade Level	Sam K	Joan 1	Betty 1	Lloyd 2
Selected area of concern and concept				
Natural A	Music	Science	Language Arts	Science
Natural C	Art			Math
Built B	P.E.	Art	Social Sciences	

MATRIX II: CHART FOR SECONDARY

Teacher's Name	Mary	Sam	Tony	Alice
Selected area of concern and concept				
Natural A	U.S. History	World History	Amer. Govt.	Calif. History
Natural C	Calif. History			Calif. History
Built B			Geog.	Calif. History

- Participants have a copy of selected area of concern and concepts. The leader asks participants to identify into which subject area(s) each concept will be infused.
- As participants call out their choices, the leader records the subject area in the appropriate box, or, if by department, the unit or subtopic (see Matrix II).

- When all participants have committed themselves, the leader asks the group to consider the entire matrix. Does the matrix reflect a balanced curriculum, or does it emphasize some subject area and not others? The group may adjust its choices to create a more balanced curriculum.
- Participants then agree to try out one or more activities for the concepts they have each selected and to report back to the group in four to six weeks.
- Optional. Participants gather activities that will teach toward their selected concepts. They use activities from the Guide (pages 21, 39, 57, and 77), suggested activities from Session I, or ideas generated in small groups. The group has modified and selected concepts to infuse into its curriculum. Each participant has then selected concepts to try out with his/her students over a four to six week period.

Assessing Progress

> Session III: The group reconvenes to assess progress toward infusing environmental education into the curriculum.

- The group leader describes the purpose and agenda for the session.
- The group divides into teams of four to six; each team meets around a table with two pieces of newsprint.
- Team members identify and record what is going well and why as they try out activities for the selected concepts. The leader moves from group to group, observing and assisting when necessary. Papers are posted.
- Team members then identify and record problems they are having as they try out activities. They list reasons for those problems and post papers.
- The teams are now ready to determine the next step(s) toward infusing environmental education into the curriculum. Given the things that are going well, the problems and the reason for each, what are some next steps? Possibilities may be:

  To continue with current program, with little or no adjustments.
  To gather more activity ideas, based on those that have been successful.
  To focus on solving one or more problems that seem to be major hindrances.
  To try activities from the Guide.
  To gather other resources listed in the Guide (see page 93).
  To schedule an in-service in environmental education.

- The group leader assists the participants as they decide on what specific action to take. S/he helps them outline necessary steps toward that action and divide up responsibilities so that necessary action is taken.
- Dates are set for getting together to review progress. The group has reviewed and assessed its progress toward infusing environmental education into the curriculum; it has also identified any necessary future actions. The procedure outline in Session III can be an ongoing process.

AN INDIVIDUAL APPROACH

The following procedure is designed for an individual teacher who plans to infuse environmental education into his/her curriculum.

1. Refer to the environmental education curriculum matrix on page 13 of the Guide. This matrix will help you select the appropriate subject area(s) and related concepts for teaching environmental education in your classroom.

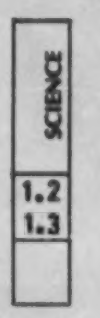
2. Subject areas are listed across the top of the matrix.

***COURSE OF STUDY GOALS AND OBJECTIVES**

ART	BUSINESS EDUCATION	CONSUMER/ HOME EC.	DRAMA/ THEATRE	ENGLISH LANG. ARTS/ READING	FOREIGN LANGUAGE	HEALTH	INDUSTRIAL ED.	MATH	MUSIC	PHYSICAL EDUCATION	SCIENCE	SOCIAL SCIENCE

Choose the subject area(s) into which you will infuse environmental education.

3. Under each subject area you will find numbers which refer to objectives in the **Course of Study**. Locate each numbered objective for the selected subject area(s) by referring to page 15. Read the selected objective. If they are appropriate for your students, refer back to the matrix.



4. You will note that the **Course of Study** objectives are matched to environmental education concepts, which are listed down the left side of the matrix.

NATURAL ENVIRONMENT	A. The natural environment functions according to patterns of established relationships between living and nonliving things.
	B. All species of plants and animals live in habitats and many species exploit more than one habitat in order to meet their needs.
	C. The sun is the ultimate source of energy which all life on earth needs in order to exist.
	D. The environment is being shaped continually by naturally & humanly produced forces which can alter the balance of conditions & lead to changes in the plants & animals which are able to exist there.

Read those environmental education concepts that correlate with the numbered **Course of Study** objectives noted above. If these environmental education concepts are appropriate for your students, you are ready to select objectives and activities for your curriculum.

5. Environmental objectives are listed under the four major areas on the following pages:

Natural Environment, page 20

Built Environment, page 38

Social Institutions and Decision Making, page 56

Energy and Environmental Resource Management, page 76

Refer to the appropriate pages, locate the selected concept(s). Choose one or more objectives under each selected concept.

Review activities which are matched to those objectives. Select activities to try with students (or gather activities from other sources).

After trying out activities, identify what went well and what were some of the problems. Modify your program accordingly.

If you wish to infuse environmental education into other subject areas, repeat these procedures.

ENVIRONMENTAL EDUCATION CONCEPTS

COURSE OF STUDY GOALS AND OBJECTIVES

		ART	BUSINESS EDUCATION	CONSUMER/ HOME EC.	DRAMA/ THEATRE	ENGLISH LANG. ARTS/ READING	FOREIGN LANGUAGE	HEALTH	INDUSTRIAL ED.	MATH	MUSIC	PHYSICAL EDUCATION	SCIENCE	SOCIAL SCIENCE
NATURAL ENVIRONMENT	A. The natural environment functions according to patterns of established relationships between living and nonliving things.												1.2 1.3	
	B. All species of plants and animals live in habitats and many species exploit more than one habitat in order to meet their needs.													
	C. The sun is the ultimate source of energy which all life on earth needs in order to exist.													
	D. The environment is being shaped continually by naturally & humanly produced forces which can alter the balance of conditions & lead to changes in the plants & animals which are able to exist there.	1.1						3.1		3.4		5.3	4.3	1.2
BUILT ENVIRONMENT	A. Built environments depend on resources from the natural environment for survival.			3.1										
	B. The design and maintenance of built environments have both reflected and influenced the values, ethics, and lifestyles of the inhabitants.			3.2 1.1 1.2			3.2		4.3			5.4		4.3
	C. Built and natural environments function in similar ways and share many basic needs for survival and growth.							1.4						
SOCIAL INSTITUTIONS AND DECISION MAKING	A. Environmental problems transcend political entities, state and national boundaries & cultural differences.						3.1							4.1
	B. The goals for every society include economic prosperity which is based, in part, on natural resources.		4.4											
	C. Individuals & private groups within our society & independent of the major social, economic, & political decision-making institutions play an important role in developing public awareness of environmental issues & in monitoring public and private activities in relation to the environment.	4.4		3.3	1.2 4.2	6.2		3.3						3.1
	D. Educational institutions & communications media are potential sources for the creation of public awareness of environmental issues.							2.3			4.3			
	E. Environmental law is intended to regulate use of the environment for present & future generations.							2.1 3.2						
RESOURCE MANAGEMENT	A. There are a number of historic & present day models which can be used in developing management programs.													
	B. Conservation is the most immediate way of increasing the real supplies of a natural resource. Conservation practices focus on more efficient uses of natural resources.													
	C. Some resources are renewable & can be maintained so they will provide consistent & continuous supplies of resources as they are needed.								4.2					
	D. To understand the role of the resource agency & its departments in maintaining the productivity of our natural resources into the future.													

PROCESS GLOSSARY

Advocacy is a process that can be used with a group to help discuss the pros and cons of a series of options. The rules are:

- Individuals have 30 seconds to lobby for or against the importance of an option.
- An individual may have additional 30-second periods as long as each period is preceded by someone else's 30 seconds.

Advocacy provides a group with a structure to assist individuals to hear each other. The leader explains the rules, suggesting that individuals name the item they are promoting or not promoting. S/he assists individuals to advocate and monitor the time.

Consensus

Consensus is a process that can be used with a group to reach maximum agreement among its members. Agreement is usually made by a group among a number of options. The leader assisting a group to reach consensus makes sure that everyone understands the options being considered. S/he asks for suggestions as to which options the group wants to take on. These options are noted. S/he points out each option asking the question, "Is there anyone who can't live with the group selecting this option?" If no one objects, the group has reached consensus. If some members object, the leader moves to a next option. This continues until one or two options have only one or two objectors. The leader can ask the one or two what needs to be done to enable them to live with the option. The leader checks out the change with the group.

Curriculum Rating Process

This process may be used to select the curriculum areas in which to infuse environmental education. Individuals are asked to rate the potential for infusion for each of the identified curriculum areas according to this scale.

3-Excellent Potential 2-It's Possible 1-Very Improbable, Forget It

Individuals record their ratings on a chart.

	Person #1	Person #2	Person #3	Person #4
LANGUAGE ARTS	1	1	1	1
SCIENCE	3	3	2	1
SOCIAL SCIENCE	2	3	3	2

Scores are totaled; areas receiving high scores are the better candidates for infusion.

Rank Order

Rank order is a process that takes individual orderings of a set of items and accumulates the ranking to obtain a group ordering. The items to be ordered are labeled by a letter — A, B, C, etc. Each individual is given small 3" x 5" sheets of paper. Each paper is labeled A, B, C, etc. Each person is directed to order his or her papers according to importance. S/he is then asked to number the papers 1, 2, 3, etc.; 1 is the most important.

All the A's, B's, C's, etc., are collected. The numbers on each of the A's are added, then the B's, then the C's, etc. The letter of the option receiving the lowest total number is the most important.

Working in Groups of Four to Six Persons

Rather than work with staff in large group discussion, it may be helpful for groups to work in smaller groups in discussion and decision making. The leader can ask the subgroups to work on tasks of reviewing information, developing options, and forming decisions.Then s/he can collect items from each group and record them on the chalkboard or butcher paper. This helps the group review its comments and reach a decision.

COURSE OF STUDY OBJECTIVES THAT RELATE TO ENVIRONMENTAL CONCEPTS

ART

1.1 To develop awareness of color, shapes, and textures in human-made and natural environments.
4.4 To demonstrate skill in using creative expression as a means of bringing about constructive action to solve social and environmental problems.

BUSINESS EDUCATION

4.4 To develop an understanding of business economics.

CONSUMER/HOME ECONOMICS

1.1 To develop an awareness of personal values in relation to different lifestyles.
1.2 To develop an awareness of personal resources in relation to different lifestyles.
3.1 To develop an understanding about the relationship of housing choices to aesthetic, social, and environmental issues.
3.2 To understand how personal lifestyle choices affect the quality of the environment.
3.3 To understand how community, state, and federal resources are used to provide services within a community.

DRAMA/THEATER

1.2 To develop problem-solving skills through creative drama and improvisation.
4.2 To become aware of the role of drama/theater in influencing public opinion in areas of merchandising, human relations, and politics.

ENGLISH LANGUAGE ARTS/READING

6.2 To develop skills for making critical analyses of written materials and media presentations.

FOREIGN LANGUAGE

3.1 To understand the attitudes and values, customs, traditions, and taboos which make up the culture.
3.2 To become familiar with the environments in which cultural groups have developed.

HEALTH

1.4 To develop strategies for daily living that build self-acceptance and reduce stress and anxiety.
2.1 To understand the causal factors of diseases or other physical disorders and develop strategies for preventing, treating, or controlling these malfunctions.
2.3 To develop skills for evaluating health information, products, and services.
3.1 To understand the relationship between ecological balance in the environment and people's mental, social, and physical well-being.
3.2 To understand the types of resources needed to protect the health of people in local, state, national, and world communities.
3.3 To develop awareness of the personal and community resources that can be used in accident prevention and in meeting emergency situations.

INDUSTRIAL ART

4.2 To develop an awareness of the basic economic structure of our industrial society.
4.3 To develop an awareness of the relationship between environment and industry.

MATHEMATICS

3.4 To develop skills for recognizing and using geometric figures in the environment.

MUSIC

4.3 To understand how cultures and historical periods influence musical styles and forms.

PHYSICAL EDUCATION

5.3 To understand the impact of various recreational activities on the environment.
5.4 To value leisure as a complementary balance to work.

SCIENCE

1.2 To be aware of order and beauty in the natural environment.
1.3 To appreciate and respect all living organisms (including self) and their place in the environment.
4.3 To demonstrate an understanding of the ways in which science and technology affect individual lifestyles and social/cultural development.

SOCIAL SCIENCE

1.2 To understand how societies develop in diverse physical and social settings and meet the needs and desires of their members.
3.1 To understand differences and similarities of the value systems held by different cultural and social groups in the American society.
4.1 To develop an awareness of social change in the past and present and to anticipate future change.
4.3 To participate in social action projects that are of benefit to the community.

Classroom Activities

Natural Environment

The classroom activities in this section are samples of ways in which teachers can address the instructional objectives. These activities help students to understand the connections between the biological and physical worlds, the unique characteristics of habitats, the fundamental importance of the sun, and the effects that the ecosphere has on natural and human forces.

Built Environment

The classroom activities in this section assist students in understanding the dependency of the Built Environment on the Natural Environment, the evolution of the Built Environment and its influence on societal values and stresses, and that the Built and Natural environments are intertwined through an intimate cause/effect relationship.

Social Institutions and Decision Making

The classroom activities in this section are samples of ways in which teachers can assist students to understand that environmental problems transcend political entities, state and natural boundaries, and cultural differences, and that individuals, institutions, and private groups within our society play an important role in developing public awareness of environmental issues.

Energy and Environmental Resource Management

The classroom activities in this section are samples of ways in which students can understand the importance of conservation, the costs and benefits of continuously renewing resources, and how we manage our resources in the state.

Natural Environment Activities

NATURAL ENVIRONMENT

Issues

The part of the Natural Environment of planet earth where all known life systems exist is a relatively thin belt of water, land, and atmosphere called the ecosphere. The ecosphere is comprised of separate, yet interrelated communities of living things called ecosystems, each with its unique mosaic of plants, animals, bacteria, and viruses. The physical and chemical environment of each community determines what can survive there; this intricate web of relationships between the biological and the physical world is fragile and continually changing.

Chemical elements, such as carbon, hydrogen, oxygen, and nitrogen, are essential nutrients for all life forms. They circulate through life systems, continually replenishing the environment and regulating the abundance of life.

Water is a principal means of transport for nutrients traveling throughout the environment. Run-off water from precipitation carries suspended and dissolved elements from the land to the oceans. Radiant energy from the sun lifts them, through evaporation, to be dispersed by wind action. This is the hydrologic cycle, the major transport system for circulating ingredients throughout the ecosphere.

An alteration in the physical or chemical composition of a natural community results in concomitant alterations in the biological compositon. Usually, these changes are gradual — a lake may slowly fill in to become a marshland, then a bog, and climax as a meadow.

Sometimes, however, the process of change may be more sudden and, hence, immediately destructive. A volcanic eruption is an example of a sudden destructive change caused by natural forces. Filling in coastal wetlands for land development is less violent but is an equally destructive change caused by human forces. Agriculture is another human force that affects a natural community, this time by preventing the natural evolution of the land from taking place. Because the tendency to diversify is held in check, agricultural lands become susceptible to disease-carrying bacteria and the invasion of pests. This condition is compounded as crop strains are further refined and farmers plant increasingly specialized monocultures.

Landfill and agricultural practices are two ways that human activity directly affects the ecosphere. Other ways are more insidious, such as industrial pollution, which enters the hydrologic cycle and results in acid rain. It is becoming increasingly apparent that humans must consider the long-range effects of their actions upon the ecosphere before the fragile web of life systems is irrevocably harmed.

Four concepts have been identified to help students understand life systems. The first is concerned with the interconnectedness between the biological and the physical worlds. The second considers the importance of habitats and their unique characteristics. The third stresses the fundamental importance of the sun. The fourth examines natural and human forces which affect the ecosphere.

NATURAL ENVIRONMENT

MAJOR CONCEPTS	OBJECTIVES
A. The natural environment functions according to patterns of established relationships between living and nonliving elements.	1. To understand that all living things play roles and have functions in relation to maintaining and renewing the natural environment. 2. To understand the web that binds together the biological community and the physical world within and between ecosystems in different natural settings. 3. To understand how biological communities of plants, animals, and microorganisms interact within different environments.
B. All species of plants and animals live in habitats and many species exploit more than one habitat in order to meet their needs.	1. To understand that different species of plants and animals depend on specific types of habitats for survival. 2. To understand that each system — water, land, air — contains resources that are important for the maintenance of life.
C. The sun is the ultimate source of energy which all life on earth needs to exist.	1. To understand how the energy radiated by the sun is used on earth to maintain ecological processes. 2. To understand that energy can be stored by plants and converted through natural processes into large scale energy sources, such as petroleum, natural gas, and coal. 3. To understand that energy can neither be created nor destroyed. It is in a constant state of flux.
D. The environment is being shaped continually by natural and human forces which alter the balance of conditions and lead to changes in plant and animal populations.	1. To understand the factors which determine the variety and abundance of life that can be supported within a geographic area. 2. To understand how the biological community of plants, animals, and microorganisms adapt to the environment through changes in genetic composition and population size. 3. To understand how humans manipulate the environment and cause changes in the balance of conditions. 4. To understand the natural forces that continually shape the environment.

NATURAL ENVIRONMENT OBJECTIVES & ACTIVITIES

		K-3	4-6	7-9	10-12
CONCEPT A	1. To understand that all living things play roles and have fuctions in relation to maintaining and renewing the natural environment.	Students take a mini-safari to find out what lives in and around a variety of microhabitats.	Students build a model food pyramid with their bodies.	Students take a census of an outdoor site "job descriptions" for the organisms observed.	Through guided imagery, art, and language arts, students assess the results of the removal of one element from an ecosystem.
	2. To understand the web that binds together the biological community and the physical world within and between ecosystems in different natural settings.	Class sets up a mini-ecosystem in an aquarium.	Students sit in a circle and pass a ball of yarn to form a "web of life."	Students calculate the amount of H_2O released from a leaf through transpiration.	Student committees present mixed media shows illustrating the ecosystem of a nearby area.
	3. To understand how biological communities of plants, animals, and microorganisms interact within different environments.	Students compost their food waste.	Students' lunches are recycled in the classroom by common decomposers.	The decomposing role of sowbugs in the forest ecosystem is studied.	Students collect and arrange specimens in a terrarium.
CONCEPT B	1. To understand that different species of plants and animals depend on specific types of habitats for survival.	Students experiment to determine how plants will grow when subjected to different "types" of water.	Students play a cooperation game modeling systems interaction.	Students take a census of two adjacent natural communities and the ecotone between them.	Students make a mural of the water cycle. They interject disruptions in the environment.
	2. To understand that each system - water, land, air - contains resources that are important for the maintenance of life.	Students hang Vaseline coated paper to collect particles in the air.	Students model a resource balanced ecosystem in a game format.	Students do a worksheet activity on the marine food chain.	Students express opinions on ocean resource issues through debate, language arts, and/or graphics.
CONCEPT C	1. To understand how the energy radiated by the sun is utilized on earth to maintain ecological processes.	Students sprout beans in a sunny area and a dark area to compare beans from each area.	A series of experiments are conducted on the use of sunlight by plants.	Students test uncovered and foil covered coleus leaves for starch production.	Students trace a favorite food back to its ultimate source and trace the use of energy in supplying the food.
	2. To understand that energy can be stored by plants and converted through natural processes into large scale energy sources such as petroleum, natural gas, and coal.	Students are introduced to plants (foods) that give them energy.	Students simulate natural oil deposits by starting a compost pile.	Students prepare and perform a role-play activity on energy transfer.	Teacher leads the class in an extended role-play, modeling the process of fossil fuel generation.
	3. To understand that energy can neither be created nor destroyed—it is in a constant state of flux.	Students participate in a cooking activity to investigate physical and chemical changes.	Students use thermometers to measure heat in classroom.	Students read several personal statements on energy as a stimulus to expanding their own perspectives and writing their own poems.	Students examine the role the sun has played in the culture, past and present.
CONCEPT D	1. To understand the factors which determine the variety and abundance of life that can be supported within a geographic area.	Students investigate different sites in an outdoor area for heat, wind, moisture, etc.	Students experience directly the dramatic results of disruptions in an ecosystem.	Students find the locations outdoors, which are warmest, coolest, brightest, etc. (see level 1).	Through experiments and observation games, students make judgments on probability and desirability of trees in the environment.
	2. To understand how the biological community of plants, animals, and microorganisms adapt to the environment through changes in genetic composition and population size.	The group hunts for colored "worms" in two habitats and compares results.	Students role-play deer in a forest by looking for food, water, and shelter. A rock/paper/scissors game.	Students design animals or plants and explain the reasons for the organisms survival or extinction.	Students research local endangered species, analyze the problem, and prepare action statements.
	3. To understand how humans manipulate the environment and cause changes in the balance of conditions.	Students take a walk to examine the micro-habitats on and near walls.	Students simulate chemicals causing environmental changes and try to control their use and abuse.	Students set up indicators for CO and O^3 in several outside locations.	Students rate environmentally sensitive practices on a values continuum.
	4. To understand the natural forces that continually shape the environment.	A model stream table is set up. Students manipulate water flow and land forms.	Students write stories about, and act out, the natural forces which shape our environment.	Students construct a model of geological evolution — before and after demonstration.	Students assess the posssible causes of global glaciation and write a disaster film script.

PYRAMID OF LIFE

DESCRIPTION
Students build a model food pyramid with their bodies.

OBJECTIVE
A-1. To understand that all living things play roles and have functions in relation to maintaining and renewing the natural environment.

PURPOSE
To help visualize how more soil and plants are needed to support fewer animals in a food pyramid.

Time	Where
10-15 minutes	Lawn or gym mats
Topics	**Materials**
Food chains, interdependence	Names of living and nonliving elements written on scraps of paper

LEAD-UP/PREPARATION
Brainstorm and list all the things we need to survive on the chalkboard (air, water, clothing, shelter, plants, animals, etc.). Students then divide the list into living and nonliving things, working individually. Discuss "borderline" materials, like cotton and paper, that were once living but are now dead. Have the class decide into which category these borderline items should go or whether a third category should be created.

ACTIVITY

Step 1
Have students pull names of living and nonliving elements of the environment out of a bag—elements: soil (9), plants (8), animals (7), decomposers (6).

Step 2
Go to the nearest lawn or gym mats. Teacher instructs students to follow directions:

- Since soil is the base for all life, all soils kneel down on all fours, shoulder to shoulder, close in a line.
- All the plants line up behind and parallel to the soil. Animals line up behind the plants, and decomposers line up behind the animals.
- The plants climb gently on top of the soil, also on all fours, adding the second level to the pyramid.
- The animals now climb on top of the plants.
- Finally, the decomposers climb up to the fourth and highest level of the pyramid (which should successfully "decompose" the entire pyramid).

Step 3
Discussion. After untangling, share the difficulty of just nine soils supporting eight plants, seven animals, and six decomposers.
Q: What would have happened with the entire pyramid in place if two of the soils "eroded" or two of the plants were sprayed with "herbicide"?

FOLLOW-UP
1. Reemphasize the importance of the role of all living and nonliving things in the environment and how any major change will affect the entire food pyramid.
2. Remembering the original lists of living and nonliving things we depend on to survive, discuss or write short stories about how our lives would change and what adaptations we would have to make to do without one of them.

WEB OF LIFE

DESCRIPTION
Students sit in a circle and pass a ball of yarn to form a web of life.

OBJECTIVE
A-2. To understand the web that binds together the biological community and the physical world within and between ecosystems in different natural settings.

PURPOSE
To show interactions between living and nonliving things in the environment.

Time	Where
10-15 minutes	Floor, playground, or lawn
Topics	**Materials**
Ecosystem, interdependence, animals, plants, natural resources, food chains	Large ball of yarn

LEAD-UP/PREPARATION
1. Divide class into six small groups to brainstorm as many human interactions as they can think of that help them survive. Each group has one theme:
   - How does *water* get to my home and what role do humans play in the process?
   - The same for *clothing*
   - The same for *housing/shelter*
   - The same for *plant food*
   - The same for *animal food*
   - The same for *energy*
2. Share their lists of interactions with the class as a whole.
3. Trace the energy needed to produce and transport clothing, shelter, and plant and animal food back to its nonliving sources (soil, air, water, and sunshine).

ACTIVITY

Step 1
Based on the lead-up activity, have each student pick a living or nonliving thing s/he wants to represent. Make sure the basics—air, water, soil, and sunshine—are included.

Step 2
Have the class sit in a circle.

Step 3
Begin by handing a ball of yarn to one of the "basics" and asking who in the circle is connected to it in some way.

Step 4
If a student feels the living or nonliving thing s/he represents is connected to this "basics" in some way, s/he explains how. The ball of yarn, after the end is wrapped around the "basics" finger, is then passed or rolled to the student who has explained the connection or interaction. This student then takes up the slack and winds the yarn around his/her finger.

Step 5
This process of passing the yarn to the next student who sees a connection continues until everyone is connected in a web of life.

Step 6
With all the slack taken up, one of the factors in this ecosystem wiggles his/her string finger up and down. Everyone who can feel that wiggle raises his/her free hand. Repeat this and emphasize the interconnections between all living and nonliving things in the environment.

FOLLOW-UP
1. Draw a web of life within your school that shows how principal, gardeners, teachers, students, cafeteria workers, custodial staff, etc., interact and support each other.
2. Write thank you letters to one of the people or groups that support you at school, thanking that person or group for supporting you in your school web of life.

Adapted from *Project Learning Tree*

RECYCLE-ARIUMS

DESCRIPTION
Students' lunches will be recycled in the classroom by common decomposers.

OBJECTIVE
A-3. To understand how biological communities of plants, animals, and microorganisms interact within different environments.

PURPOSE
To make daily observations of different decomposers recycling leftovers from students' lunches in controlled environments.

Time	Where
30 minutes to set up	Outdoors
2 weeks to observe	Classroom
Topics	**Materials**
Ecosystem, food chains, recycling	Dirt, lunch leftovers, snails, sow bugs, glass jars with lids

LEAD-UP/PREPARATION
"There is a natural recycling of earth's resources that keeps rebuilding the raw materials that plants and animals need to survive. Scavengers, such as earthworms, snails, and sow bugs, begin the recycling process by eating dead matter and breaking it into smaller parts. Any dead matter (like lunch leftovers) or feces not eaten by scavengers serves as food for decomposers, such as fungi, bacteria, and mold. These decomposers complete the recycling process by using the nutrients and returning unused materials to the soil for use by other plants and animals."

ACTIVITY

Step 1
Save all lunch leftovers except meat for one day.

Step 2
Place an equal amount of a variety of leftovers on top of one inch (2.5 cm) of soil that is at the bottom of three to four large peanut butter or jelly jars. (Use bread, fruit, vegetables, etc.). Sprinkle a little water into each jar to moisten the leftovers. Poke holes in each lid.

Step 3
Hunt outdoors for earthworms, sow bugs, and snails (ivy beds are great places to look, digging for worms after rains or watering is much easier, too).

Step 4
Place several snails or slugs in jar #1 and replace the lid.

Step 5
Place several earthworms in jar #2 and replace the lid.

Step 6
Place several sow bugs in jar #3 and replace the lid.

Step 7
Leave the leftovers in jar #4 alone and put the lid on after moistening with water.

Step 8
Place the jars in a light place that doesn't get direct sunlight and make daily observations of the recycling in each jar.
Q: What gets eaten first?
Q: What do the droppings of the scavengers look like?
Q: Does anything decompose the droppings?
Q: What happens to jar #4 that has no scavengers? (mold?)
Q: How long do recycling and decomposition take in the different jars?
Q: Who wants to take the recycled nutrients home to grow more lunch in their garden, or could you start a school garden?

SNAILS LIKE UNDERSIDES OF LEAVES IN DAMP AREAS

SOWBUGS LIVE IN DECOMPOSING LEAF MOLD

EARTHWORMS LIVE UNDERGROUND IN MOIST PLACES

FOLLOW-UP

Repeat experiment, substituting inorganic waste items (cans, plastic wrap, etc.). Can the decomposers break them down?

Adapted from Greenbox

INTER-ECO-ACTION

DESCRIPTION

Students play a cooperation game modeling systems interaction.

OBJECTIVE

B-1. To understand that different species of plants and animals depend on specific types of habitats for survival.

PURPOSE

To experience the interaction of different ecosystems with each other in the biosphere.

Time	Where
10 minutes	On lawn or floor
Topics	**Materials**
Ecosystem	None

LEAD-UP/PREPARATION

Ecosystems are self-contained units in many ways, but two different ecosystems can exist right next to each other. An example is where a forest stops and grasslands begin. Different plants and animals will live and interact in these two different ecosystems. But interactions between the two systems may be minimal, even though they exist side by side.

ACTIVITY

Step 1

Divide the class into two local model ecosystems that share a border and pair up members, one from each ecosystem. Sit each pair down back to back with their elbows linked together.

Step 2

When ready, they raise their knees up with feet on the ground and push against each other's backs until they push themselves up into a standing position.

continued

Step 3
Now try it with three or four ecosystems in a circle.

Step 4
See if you can do the whole biosphere by linking elbows with the whole class in a circle or in two lines back to back and standing up.

Step 5
Talk about whether it is easier or more difficult standing up with more ecosystems pressing on each other. If an "ecosystem" next to you collapsed, were you pushed towards the gap? How do you think this is like things in nature? (For example, when a forest burns, what fills in the gap?)

FOLLOW-UP

Pretend your class and the class next door are ecosystems that border on each other. Have both classes record what they do and when they do it on the same day. Compare the logs the following day to see what each ecosystem has in common and what differences make them unique.

Adapted from The New Games Book

HEALTHY INTERACTIONS

DESCRIPTION

Students model a resource-balanced ecosystem in a game format.

OBJECTIVE

B-2. To understand that each system—water, land, air,—contains resources that are important for the maintenance of life.

PURPOSE

To experience the importance of all living and nonliving things that maintain the health and welfare of ecosystems through their interactions.

Time	**Where**
10-15 minutes	Lawn or playground
Topics	**Materials**
Ecosystem, natural resources, environmental values	None

LEAD-UP/PREPARATION

1. Brainstorm a list of the resources students need in their lives to stay healthy (food, shelter, clothing, water, clean air, medicine, vitamins, protection, etc.). The people who provide these resources should be listed alongside the resources on the chalkboard.
2. Write stories, songs, or poems about the resources listed that show their importance to you. Get ideas from personal experiences, TV shows, books, etc. Give students the opportunity to share their creations with the class or in smaller sharing circles.

ACTIVITY

Step 1
Divide students into groups of 8-12. Each group forms a circle, shoulder to shoulder, facing inward.

Step 2
Everyone reaches out and grabs the hands of two different people from across the circle.

Step 3
When everyone is connected, explain that this represents the different interactions going on within an ecosystem.

Step 4
Now, without letting go of any hands, untangle the knot by stepping over, under, and around everyone else. Circles that finish first (usually ending up in one big circle) might want to give advice to other circles or try it again.

FOLLOW-UP
Do the Web of Life activity, page 23.

Adapted from The New Games Book

A PLACE IN THE SUN

DESCRIPTION
A series of experiments are conducted on the use of sunlight by plants.

OBJECTIVE
C-1. To understand how the energy radiated by the sun is used on earth to maintain ecological processes.

PURPOSE
To observe effects of sunlight and lack of sunlight by plants.

Time	Where
Setup: 30 minutes Observation: 1-2 weeks	Classroom and outdoors
Topics	**Materials**
Plants, scientific methods	3-6 plants, 2-3 cardboard squares or circles, milk cartons

LEAD-UP/PREPARATION
Plants need air, water, soil, and sunlight to grow. Through photosynthesis, green plants convert sunlight into sugars that help the plant grow. In turn, animals eat the plants in order to grow.

ACTIVITY

Step 1
Assign students to bring in a half-gallon milk carton for each plant that you grow.

Step 2
Cut the carton in half, poke some holes in the bottom, and fill the carton three-fourths full with potting soil or compost. Place each carton on a plate or pie tin that will catch water that runs out of the holes in the bottom.

continued

Step 3
Bring in sproutable vegetables from home, such as carrot tops, sprouted potatoes, or dried beans, and plant them in the containers just below soil level.

Step 4
Place two containers in direct sunlight, two in indirect sunlight, and two in the dark. Water each plant three times each week and make sure each gets all the air it needs.

Step 5
Make observations on watering days of how the plants are doing: How tall are they? How green are they?

Step 6
After one to two weeks, bring all the plants together to study and draw conclusions about the effects of different amounts of sunlight.

FOLLOW-UP
Take small squares of cardboard and paper clip them carefully and gently on the sunny-side of leaves outdoors. At the end of the week, check for the effects of lack of sunlight by removing the cardboard and comparing the covered part to the rest of the leaf.

ENERGARBAGE

DESCRIPTION
Students simulate natural oil deposits by starting a compost pile.

OBJECTIVE
C-2. To understand that energy can be stored by plants and converted through natural processes into large-scale energy sources, such as petroleum, natural gas, and coal.

PURPOSE
To learn what we can do to recycle energy in our own lives since we are running out of energy from fossil fuels.

Time	Where
Setup: 30 minutes Follow-through: 4 weeks	Classroom
Topics	**Materials**
Biomass, fossil fuels, gardening, resource management, recycling	Large trash bags

LEAD-UP/PREPARATION
Discuss the fact that oil and gas *do not* really come from dinosaur remains, but actually from microscopic plants and animals. Dinosaurs are used as a symbol for ancient animal life in commercials and elsewhere.

Microscopic animals and tropical plants growing in California millions of years ago died and decayed. The microscopic animals and plants, under pressure and heat for millions of years, turned into oil.

Because it takes millions of years to make oil, we have to conserve the energy we get from the fossil fuels we have and find new ways to turn plants into energy. One way is composting.

ACTIVITY

Step 1
Save all the lunch leftovers from the class for a week and put them in large plastic trashbags.

Step 2
Add leaves and plant prunings from the school yard.

Step 3
Add some soil and earthworms that students bring from home.

Step 4
At the end of the week, tie the bags up tightly and gently mix up all of the ingredients by rolling and shaking the bags.

Step 5
During the next three weeks, mix the ingredients up on Monday, Wednesday, and Friday in the same way.

Step 6
The fourth week, open the bags and look at the rich soil you have created.

Step 7
Talk about how the composting you have done is similar to and different from the way prehistoric tropical plants turned to oil.

FOLLOW-UP

1. Use the compost for a school garden to use its energy to produce more vegetables.
2. Use the compost to sprout radishes, potatoes, tomatoes, and so forth in the classroom. Cut milk containers in half, filling them with compost; plant seeds and water regularly.

HEAT WAVE

DESCRIPTION
Students use thermometers to measure heat in the classroom.

OBJECTIVE
C-3. To understand that energy can neither be created nor destroyed. It is in a constant state of flux.

PURPOSE
To measure how one form of energy can change to another form in the classroom.

Time	Where
Several sessions—10 minutes each	Classroom
Topics	**Materials**
Energy resources, solar energy, thermodynamics	4 thermometers, one desk lamp

LEAD-UP/PREPARATION
Energy can't be created or destroyed, but it can change from one state to another. Gasoline's potential energy changes to mechanical energy to turn the wheels on cars. But some of the energy is lost as heat. Engines get hotter and there is friction as the car keeps going. Your body works in a similar way. The energy from food is converted to mechanical energy that you can use to run. If you run for awhile, your body will get hot because some of the food's energy is lost as heat. Every time energy changes from one state to another, some energy is lost as heat. This heat can be measured in the classroom.

ACTIVITY

Step 1
Divide the class into four teams of scientists. Give each a thermometer.

continued

Step 2
Assign one group to measure the temperature difference between the desk light when it is on and when it is off. Have the group report its findings on how much electrical energy is lost as heat on its way to becoming light (enough heat to raise the temperature of the air X degrees).

Step 3
Do similar studies with the other three groups, having them measure the temperature of the sunlight next to the windows versus the dark side of the classroom (light — heat); the temperature of occupied chair seats versus the desk tops (food — body heat); and difference in body temperature before and after an active recess.

Step 4
Have all groups report their findings to the rest of the class.

FOLLOW-UP
Put water in a closed bottle in the sunlight to illustrate the water cycle that runs on the sun's energy on hot days. Watch the evaporating water condense like raindrops and run back down into the "lake" at the bottom of the bottle. This illustrates heat energy causing evaporation, which puts water into the air ready to fall again (potential energy).

WE NEED ALL OF US

DESCRIPTION
Students experience directly the dramatic results of disruptions in an ecosystem.

OBJECTIVE
D-1. To understand the factors which determine the variety and abundance of life that can be supported within a geographic area.

PURPOSE
To appreciate the importance of every link in an ecosystem and experience results of ecosystem changes.

Time	Where
15 minutes	Lawn or gym mats
Topics	**Materials**
Ecosystem, ecological balance	None

LEAD-UP/PREPARATION
Discuss the concept: Even though it sometimes doesn't seem likely, everything *is* connected to everything else in the world. Space, food, water, and climate are major factors affecting life.

ACTIVITY
Step 1
Gather students together in a circle, facing inward, shoulder to shoulder.

Step 2
Each student then turns 90° to the right, and is now facing the back of the person in front of him/her.

Step 3
At a signal, students sit down on the knees of the person behind—remembering to keep knees together to support the "resource" in front of them. You should now have a circle of resources supporting each other in an ecosystem.

Step 4
Test the effect of change in a delicately balanced ecosystem by having students take one step forward with their right foot while still seated. What results do you get?

Step 5
Re-circle after assigning one student to be space; one, food; one, water; and one, climate. After sitting down on each other's knees again, remove one of the four from the circle saying, "Let's just remove water to see what happens." Then ask the class whether it would like to try it again with space, food, and climate or simply hypothesize about the results. Act on their decision.

FOLLOW-UP
Share how it felt to be or not to be supported in the circle. How did it feel to have your survival depend on so many factors?

Adapted from *The New Games Book*

OH DEER!

DESCRIPTION
Students role-play deer in a forest by looking for food, water, and shelter; a rock/paper/scissors game.

OBJECTIVE
D-2. To understand how the biological community of plants, animals, and microorganisms adapts to the environment through change in genetic composition and population size.

PURPOSE
To see how a deer population adapts to a changing natural environment in order to survive.

Time	Where
15 minutes	Classroom or playground
Topics	**Materials**
Wildlife, natural resources, survival	None

LEAD-UP/PREPARATION
Discuss the following: All plants and animals need food, water, space to grow, and a hospitable climate. If any of these four essentials changed dramatically, entire animal species could be forced to migrate to other areas or could become extinct. Even subtle changes will affect the populations of an area in some way. "Oh Deer!" illustrates the population fluctuations (changes) in a herd of deer as the environment they live in changes.

ACTIVITY

Step 1
Review the game rock/paper/scissors.

continued

Step 2
Show the class the equivalent signs for food, water, and shelter: food—both hands on the stomach; water—both hands held palms down under chin; shelter—both hands making a pointed tent on top of the head.

Step 3
Divide the class in half with one-half forming a compact circle of deer and the other half surrounding them in a bigger circle and representing the environmental factors the deer depend on.

Step 4
Record the number of deer at the start of the game (one-half of the class).

Step 5
To play, the deer face the center of the circle and the environment factors face out. Each student deer decides whether it needs to find food, water, or shelter. Each "environmental factor" student chooses whether it will be food, water, or shelter.

Step 6
All students count to three out loud, together, and turn around making their signs (both circles are now facing each other).

Step 7
Keeping their signs in place, the deer must try to find the environmental factor they need and bring it back to the center of the circle. The "environmental factor" students who are found become deer in the next round. Deer that don't find what they need *die* and stay in the outer circle to become part of the environment for the next round.

Step 8
Record the increase or decrease in deer during each round, and play the game three-four more times, recording population changes each time.

Step 9
Discuss your population figures and the frustrations of living in a limited environment.
(If there's too much peeking between the circles, try parallel lines of students about 10-15 feet—2-3 meters—apart.)

FOLLOW-UP

Create some limited environments to watch what happens firsthand:

1. Put together terrariums using big jars or small fish tanks. Put a variety of plants in three-four inches (1-2 cm) of dirt at the bottom (you can use a variety of weeds from the school grounds). Introduce four-five snails. Observe which plants the snails prefer as food and whether they will eat the other plants once they run out of their favorite food.
2. Do two identical terrariums, but water one twice a week, and keep the other dry. Observe how the presence or absence of water affects the plant life and snails.
3. Vary the amount of sunlight on two identical terrariums. What makes the quickest or biggest difference—lack of water or lack of sun?

Adapted from *Project Wild*

SIDE EFFECTS

DESCRIPTION
Students simulate chemicals causing environmental changes and try to control these side effects of chemical use and abuse.

OBJECTIVE
D-3. To understand how humans manipulate the environment and cause changes in the balance of conditions.

PURPOSE
Students will experience the difficulties of controlling chemicals that have been introduced into the environment.

Time	Where
10-15 minutes	Playground
Topics	**Materials**
Chemical contamination, consumer ecology, human ecology	None

LEAD-UP/PREPARATION
New chemicals are invented to help solve some of our problems as effectively and economically as possible. We invented DDT to kill insects that were eating our crops. Unfortunately, the side effects of DDT were not well understood. It turned out that DDT also prevented birds from making hard shells for their eggs, and that many species became endangered as a result of DDT concentration in their systems. Many other chemicals are suspected as being harmful to the environment. Once we put chemicals into the environment, they *may* have unforeseen side effects. (Also, improper use and accidents can make *any* substance harmful.)

ACTIVITY

Step 1
Find a space outdoors that is limited by lines and walls and that is about the size of your classroom.

Step 2
Introduce the activity by saying, "Here is a game about the difficulties of trying to control a potentially harmful chemical once it gets into the environment."

Step 3
Students pair up and decide who is player "A" or "B." Player "A" then becomes a new chemical interacting with the environment (the walls and all the other A's and B's).

Step 4
Player "A" interacts with the environment by walking straight ahead.

Step 5
Player "B," a safety inspector from an environmental protection agency, tries to control the unwanted side effects of the new chemical by turning Player "A" from behind to keep him/her from interacting with other chemicals and the rest of the environment.

Step 6
After two minutes, switch roles.

Step 7
Discuss the difficulties of trying to regulate chemicals.

continued

FOLLOW-UP

1. Find out what chemicals are used at your school by custodians, in the cafeteria, in duplicating machines, and by gardeners. Invite an expert from a group that advocates alternatives to chemicals to work with the class and school staff to eliminate as many potentially harmful chemicals as possible in your environment.
2. Ask that person to suggest an alternative material or process which can perform the same function as the chemical s/he wishes to eliminate. How reliable, efficient, and safe is the alternative? Ask the custodian, the cafeteria manager, the secretarial staff, and the gardener how they feel about the proposed changes.
3. Recommended reading: *Silent Spring* by Rachel Carson.
4. Some chemicals which are in the news today include the insecticide kepone; the defoliant 2,4-D (a defoliant is a chemical which kills plant life); the soil purifier DBCP, and many others. Have the class find out about these and other controversial chemicals and prepare reports on their uses and the controversy surrounding their use.

CRUNCHES AND BANGS

DESCRIPTION

Students write stories about and act out the natural forces that shape our environment.

OBJECTIVE

D-4. To understand the natural forces that continually shape the environment.

PURPOSE

To understand and experience the different forces that continue to shape the earth.

Time	Where
Writing: 20 minutes Game: 15 minutes	Classroom, lawn/mats
Topics	**Materials**
Natural disasters, geology, geography	Paper and pencil

LEAD-UP/PREPARATION

1. Share stories about natural forces in the news (volcanoes, floods, earthquakes, landslides, tornadoes, fires, etc.).
2. Talk about what we've done to protect ourselves from these natural forces (homes, dams, cellars, fire departments, etc.). What have we left undone?

ACTIVITY

Step 1

Make up a short story about a mouse, frog, rabbit, grasshopper, or fish caught in a natural disaster. Tell the story as if you were the animal. Describe what it looked like and felt like and how you managed to survive in your environment.

Step 2

The following game simulates the different natural forces that keep changing the environment:

- Divide class into groups of six-seven students each.
- Five or six students in each group stand in a tight circle facing inward with the remaining member in the middle.
- The circle is the natural forces, and the person in the middle can be the animal they wrote about in the story.
- The middle student, with hands at her/his sides, feet together, and back and legs stiff and straight, falls towards the circle. The circle catches him/her and gently pushes him/her back across or around the circle. The middle student should keep his/her feet in the same spot and the circle has to remain gentle so *no one gets hurt.*
- Take turns in the center. Try it with your eyes closed. Be a trustworthy circle; don't let anyone fall through.
- After the game, point out how natural forces keep things in a changing—not static—balance.

FOLLOW-UP

1. Build a volcano out of a small jar surrounded by papier-mâché with baking soda and vinegar inside. Then discuss how volcanoes change the environment.
2. Build an erosion box (a planting flat filled with dirt and rocks and tipped at an angle). Hold a hose above and wash the dirt down. Rocks and clay soils will remain as water erodes some soil away. (See Stream Table activity in K-3 Guide.)

Built Environment Activities

BUILT ENVIRONMENT

Issues

Built Environments or human communities have evolved out of the natural environment over the past two to three million years. As innately social animals, we humans have consistently engaged in group efforts to satisfy our basic needs. Our communities stand as dynamic evidence of our efforts thus far. Human communities share many characteristics with other living systems, such as the need for nutrients, energy, food, materials for shelter, and waste disposal. Our techniques for satisfying needs and desires, however, have had much wider impact than those of any other organism. We have reached out over greater areas to gather the resources to support our lifestyles and we have deposited our wastes on the land and in the air and water.

As Built Environments continue to evolve, the quality of life for their inhabitants has improved in some respects and declined in others. We can cite astounding technological advances in areas such as health care, communications, transportation, and the production of goods. Yet, these advances have brought concomitant dilemmas. For example, advances in health care have resulted in the obliteration of many diseases and the prolongation of human lives. However, this has caused increased population growth which, in turn, has resulted in increased competition for natural resources. Advances in communications technology has made it possible to retrieve information from any part of the globe within seconds. Yet, it also contributes to a loss of control, as methods for processing information become more centralized and our individual "data banks" become overloaded. Industrialized countries have advanced exploration and transportation technologies to the point where we have access to natural resources throughout the world. Yet, the distribution of these resources is grossly unequal with 33 percent of the world's population consuming 80 percent of the available resources. Finally, advances in the production of goods have resulted in wider choices, lower prices, and an improved quality of goods for the consumer. Unfortunately, the quality of the work place has suffered as workers often find their highly automated jobs dull and meaningless.

These are merely a few of the technological advances and concomitant problems that have accompanied the evolution of the Built Environment. As we strive to build healthier communities, we must consider the central area of human environments: the cities. They serve as the hub of social, political, and economic activity. As cities grow in size and complexity, they generally become less desirable places to live. Currently, we see evidence of an increased dissatisfaction with city life as more and more people move to the urban fringe. Fortunately, we can also see evidence of efforts to revitalize the city by improving housing and public transportation and reestablishing a sense of community. As we strive to improve the Built Environment, perhaps we should begin by improving the quality of life within our cities.

Three concepts have been defined for enhancing student understanding of the Built Environment. The first considers the dependency of the Built Environment on the Natural Environment. The second considers the evolution of the Built Environment and the influence of societal values on that process. The third stresses a perspective that views the Built and Natural Environments as intertwined through an intimate cause/effect relationship.

BUILT ENVIRONMENT

MAJOR CONCEPTS	OBJECTIVES
A. Built environments depend on resources from the natural environment for survival.	1. To understand that built environments require continuous supplies of energy and resources from the natural enyironment. 2. To understand how humans manipulate and cultivate the natural environment to ensure consistent and continuous supplies of resources for built environments. 3. To understand how technology expands the geographic area from which built environments draw on resources from the natural environment.
B. The design and maintenance of built environments have both reflected and influenced the values, ethics, and lifestyles of the inhabitants.	1. To understand how geographic location, available space, people's needs for services, human contacts, and aesthetic stimulation interact in determining the design of a built environment. 2. To understand how technological development and industrial expansion have contributed to the development of the modern day megalopolis in all parts of the world. 3. To understand how individual and societal values and ethics influence the design of different types of built environments.
C. Built and natural environments function in similar ways and share many basic needs for survival and growth.	1. To understand that continuing supplies of energy are essential for the maintenance of life in both natural and built environments. 2. To understand how both built and natural environments are dependent on the continuous renewal of resources. 3. To understand that built and natural environments are continuously interactive, and changes in one area of the environment can cause changes in many other areas.

BUILT ENVIRONMENT OBJECTIVES & ACTIVITIES

		K-3	4-6	7-9	10-12
CONCEPT A	1. To understand that built environments require continuous supplies of energy and resources from the natural environment.	Students examine natural structures and build some of their own.	Students analyze a collection of items to discover what resources were used to manufacture them.	Students design and keep an energy log for one day.	In a game, students identify the materials and energy consuming processes which went into the building of the school plant.
	2. To understand how humans manipulate and cultivate the natural environment to ensure consistent and continuous supplies of resources for built environments.	Students express appreciation for natural resources contributing to their lives.	Students look "beyond" the supermarket shelves at the relationship between the land and food.	Students interview older persons to learn of the sources of resources in the past.	Students design a park for their community.
	3. To understand how technology expands the geographic area from which built environments draw on resources from the natural environment.	Small groups create a mural or mobile showing the origin of the component parts of common items.	Students find out everything they can about chalk: its origin, uses, manufacture, history, etymology.	Students read two river poems and write some of their own. The river is fragile, a metaphor for our own flow.	Students exchange "environmental materials" with another class in a different region.
CONCEPT B	1. To understand how geographic location, available space, and people's needs for services, human contacts, and aesthetic stimulation interact in determining the design of a built environment.	Students experience different "population densities" in the classroom and discuss the effects of each situation.	Students design a small town in which they would like to live, and then must resolve the problem of increasing population.	Students shop for "wants" in stores of their own design.	Through word manipulation and other arts media, students share perceptions of societies' successes and/or failures in meeting personal needs.
	2. To understand how technological development and industrial expansion have contributed to the development of the modern day megalopolises in all parts of the world.	Students draw a picture of a dwelling used in a primitive society and a dwelling from the neighborhood. They list the differences in the dwellings.	Students inventory all of the materials and energy sources needed to play baseball.	Students draw lines between environmental concepts to show interconnections.	Class takes a field trip to a local secondhand store and compares goods of different vintages.
	3. To understand how individual and societal values and ethics influence the design of different types of built environments.	Students discuss and try out ways of physically arranging the classroom.	Students inventory and evaluate the energy-using aids and appliances in their homes.	Eating pretzels as fuel, students investigate transportation alternatives through a game.	Students run an extended role-play based on a Federal Court hearing on land use.
CONCEPT C	1. To understand that continuing supplies of energy are essential for the maintenance of life in both natural and built environments.	Students do physical exercises, observe and build simple machines, and discuss energy needs for various tasks and occupations.	Students perform an experiment with yeast to show that biological functions require energy and that the system loses heat.	Students assess all of the energy that goes into a garden. Several types of gardens are detailed.	Students analyze an oil company's "energy time line" which makes predictions for the future.
	2. To understand how both built and natural environments are dependent on the continuous renewal of resources.	Students examine changes in water, air, and the sun's movement on the school grounds.	Students draw pictures of their dwellings if environmental factors (space, climate, etc.) were changed.	Students assess the artist's values through analysis of landscape painting.	Students outline the environmental implications of the freedom to live wherever they desire.
	3. To understand that built and natural environments are continuously interactive and changes in one area of the environment can cause changes in many other areas.	Students list all of the things a plant needs for survival and then extend these factors to their own cases.	Students examine the differences which exist on different sides of a building with respect to the plant life and other environmental factors.	Students examine human uses of snow in various regions.	Students generate a list of possible environmental happenings and then list the consequences of those.

WHAT'S MY RESOURCE?

DESCRIPTION

A collection of common classroom and household items is analyzed to discover what resources were used to manufacture them. The class plays a game based on natural resources and energy sources that contribute to the manufacture of the product.

OBJECTIVE

A-1. To understand that built environments require continuous supplies of energy and resources from the natural environment.

PURPOSE

To inventory the resources needed to manufacture a variety of consumer products and become more aware of the demands placed on the environment by the manufacturing of goods.

Time	Where
2 activity periods, ½ hour each	Classroom
Topics	**Materials**
Renewable resources, nonrenewable resources, energy, human ecology, technology	10 household items, such as: pencil, leather shoe, T-shirt, candy bar, milk carton, newspaper, soda bottle, plastic cup, flashlight; 10 poster boards, 50 cm × 80 cm (heavy paper or cardboard from old boxes will serve); 1 roll of tape; 1 felt marking pen; 1 box of crayons

LEAD-UP/PREPARATION

1. Gather a collection of consumer items such as those listed above.
2. Get ten poster boards of about equal dimensions. They should be large enough for students to write three columns of information.

ACTIVITY

Step 1

Tell the students, "I have a collection of common items here (show a few) that I got at stores in our community. They were all made from *materials* brought to factories, sometimes from great distances. The starting materials that were used to manufacture things are called *natural resources*."

Step 2

Hold up a pencil. Invite the class to identify the material it is made of and then the natural resource from which the material was derived. Write them on the chalkboard as they are called out. They might list:

Wood - trees
Glue - plant and animal products
Paint - oil
Lead - minerals
Metal - minerals
Rubber - oil

Step 3

There are two major kinds of resources: those from *living* sources and those from *nonliving* sources. Resources from *living* sources can be grown (plants and animals) to meet the needs of society and are often called *renewable resources*. *Nonrenewable resources* are present in limited quantities. When they are all used up, they are gone for good. Ask the students to identify the *renewable resource* on the "pencil" list, and write an "R" after it (trees = R).

Step 4

Divide the class into teams of three. Let each team come up and select one item from the collection and one posterboard. Instruct the group to tape the item securely near the top of the posterboard. Have students create three columns under the item. Have them label the three columns: materials, resources, and energy sources. Resources should be followed by an "R" if they are renewable.

Step 5

The teams work to fill in the first two columns of their posterboards.

Step 6
At a later time, call one team to the front of the room to share its poster. Ask the class to comment.

Step 7
Tell the students that for work to be done, energy must be used. One of the simplest kinds of energy is human energy. Have students give examples. People use other kinds of energy when they need to do a lot of work or when they need a lot of heat. Burning wood, coal, oil, or gas will provide heat. Electricity provides light and runs motors.

Step 8
Let each team have a turn sharing its poster. At the conclusion, put up all of the posters in a display, and ask these questions:

1. Which product had the most materials? The fewest materials?
2. Which product used the most renewable resources? Which used none?
3. Which products required the most energy?
4. A natural resource often overlooked in manufacturing is water. Which item used the most water?
5. Which items used *only* renewable resources and person-power for energy?

FOLLOW-UP

1. The ancient philosophers saw a universe made up of only *four* elements: fire, air, earth, and water. The *fire* was the sun, the *air* was the atmosphere, the *earth* was the minerals, and the *water* was just that—the water. Make believe that you are an ancient philosopher looking at these modern consumer products. Classify each material and energy source into one of the ancient elements.
2. Be resourceful. Make a product that uses only renewable resources and person power. Bring it to class and share it. Explain where you acquired your resources and how much energy went into the project.
3. Make a collage of magazine pictures. Include representations of natural resources, materials ready for manufacturing, and finished products. Give the work of art a title, and display it in a community place: another classroom, in the halls, in the library, or some other place.
4. See Keep on Truckin' activity, Built A-3, in K-3 Guide.

SUPERMARKET SURVEY

DESCRIPTION

Students look "beyond" the supermarket shelves to better understand the relationship between the land and the food that provides our nutrition. They take a field trip to a supermarket in order to gather data concerning sources, transportation, storage, and value of various food products.

OBJECTIVE

A-2. To understand how humans manipulate and cultivate the natural environment to ensure consistent and continuous supplies of resources for built environments.

PURPOSE

Students will develop the idea that food is a resource that is directly linked to the land, become aware of the differences between prepared food and food products, and learn some consumer skills.

Time	**Where**
2 activity sessions, 1 hour each	Supermarket or classroom
Topics	**Materials**
Consumer ecology, food, economics	For each team: supermarket interview form, pencil, cardboard "clipboard" with rubberband

LEAD-UP/PREPARATION

Arrange with the market manager for a class visit. Arrange for several adult assistants. Prepare questions for interviews with the butcher, the produceperson, the dairyperson, or the stock clerk. Discuss and adapt the interview forms. Discuss terminology so students are prepared for the visit: shelf life, ingredients, nutrition, junk food, protein, storage system, produce, butcher, packaging.

continued

ACTIVITY

Step 1

Discuss food as a resource used to keep us healthy and strong. The market is the place we go to get these resources. They are found in hundreds of forms and packages. Food resources do not originate at the market; they are farmed and processed all over the world and transported to the stores.

Step 2

Ask the students to come up with a list of the various food departments in the market (meat, fish, dairy, frozen, produce, etc.). Make up interview questions and interview the department managers. Below is a sample for the produce manager.

SAMPLE INTERVIEW

THE PRODUCE WORKER

Name _____

How did you get to be a produce worker?

Where do the store tomatoes come from in winter?_____ spring?_____ summer?_____ fall?_____

Which produce on the counter today comes from the farthest away? _____

Where is it from? _____

How does it get here? _____

What's the best value today? _____

Why? _____

Which products are grown in this county and what time of year do you stock them?

How do you keep your vegetables fresh?

Do any of your foods have sprays, oils, or other coatings customers should wash off before eating the food?

What do you do with wilted or spoiled products?

What percentage is that?

Which vegetables have the most protein?

Thank you very much for your kind assistance!

FOLLOW-UP

1. Send "thank you" letter to the grocery store personnel.
2. Share each group's findings and interview items.
3. Create a lunch menu using items only from California.
4. Assign students to create ads for various nutritious products. Have they seen many ads for fresh fruit, milk, meats? How could we make healthy food as appealing or more appealing than "junk" food?
5. Write jingles or poetry promoting nutritious foods; set them to a familiar tune and sing.
6. Bring in supermarket ads from the newspapers. Post the ads and study them. Do math problems figuring which store has the best buys and poorest buys.
7. Plan a nutritious meal without using meat products.
8. What form of food storage is most expensive? What benefits does this method have?
9. Discuss packaging. How much is recyclable? How much is waste?
10. Read the ingredients on a package of a *prepared food* (donuts, cookies, pie, etc.). Calculate the price of the raw ingredients. Why is the prepared food more expensive? Where are the hidden costs?
11. Discuss the water requirements for producing quantities of various foods.

TROUBLE-SHOOTING

1. Be sure to prepare students for the visit to the market. Role-play shopping behavior if necessary. No running, no yelling, no goofing off.
2. Some mathematical calculations are implied by this activity. These operations can be simplified by the use of hand calculators. Orient the students to the use of calculators before going to market *if you choose to use them.*

Adapted from *Manure to Meadow to Milkshake*

CHALK

DESCRIPTION
Students find out *everything* they can about chalk: its origin, uses, manufacture, history, etymology, etc.

OBJECTIVE
A-3. To understand how technology expands the geographic area from which built environments draw on resources from the natural environment.

PURPOSE
To make students aware of the complexity which exists in the interaction between the built and natural environments, especially in the realm of technological exploitation of the natural by humans.

Time	Where
Student homework	Classroom, library, home
Topics	**Materials**
Technology, consumer ecology, geology, nonrenewable resources	Library access

LEAD-UP/PREPARATION
Discuss: We all use chalk at least every once in a while. I use it almost every day; yet, I never really looked into it, never really found out much about it. I know that it comes from the ground, that there are large deposits of it in the U.S. and in Europe, but that's about all. There are many things I use every day and to find out about them all would be impossible, but I can choose one and find out everything about it so that I will have some idea about how really complicated and fascinating the world around me is. Let's find out everything we can about chalk!

ACTIVITY
Step 1
Set up a box and a bulletin board somewhere in the room and label them "For Project Chalk ONLY!"

Step 2
Assign the following tasks to small groups and individuals:
Tasks
1. Look up chalk in the encyclopedia. What information can you find about:
   - What it's made of?
   - Where it comes from?
   - What its uses are other than for writing on the board?
   - Other possible sources of information?
2. Look up chalk in the dictionary. Copy all of the meanings you find there. Have the teacher help you read about the origin of the word chalk.
3. Look up chalk in your science book. Is there any reference to chalk in it? Chalk is a kind of limestone, a rock type. Are there any references to limestone in your science book? If not, check for references in science books for the other grades.
4. Write to the company that makes the chalk used in your classroom. Company addresses might be found on boxes. If not, have your teacher check with your school district's central purchasing office for the address. Ask the company to send you any information it has on chalk. See if you can figure out how the chalk got from the ground to the manufacturing plant to the distributor to central purchasing to your school.

continued

5. Here are some hard words for you to look up which have to do with chalk. Use the dictionary and/or the encyclopedia to find out about the following words:
   - Calcareous
   - The White Cliffs of Dover
   - Cretaceous Period
   - Whiting matter for ceramics
   - Calcium carbonate (optional, for the advanced student)

   Have students place their gathered materials in the box.

Step 3
Create a "Project Chalk" bulletin board.

FOLLOW-UP
Choose other "every day" materials to research. Check for references to the chalk or limestone industry (cement) in trade journals, business magazines, and/or geological journals.

BIGGER IS BETTER?

DESCRIPTION
Students design a small town in which they would like to live, and then must resolve how to deal with an additional 1,000 people moving in.

OBJECTIVE
B-1. To understand how geographic location, available space, and people's needs for services, human contacts, and aesthetic stimulation interact in determining the design of a built environment.

PURPOSE
To better understand the relationship between services, space, population size, and our quality of life.

Time	Where
2 to 4 one-hour periods	Classroom
Topics	**Materials**
Consumer ecology, environmental values	Large pieces of papers, colored construction paper, tape, marking pens

LEAD-UP/PREPARATION
Assemble materials.

ACTIVITY

Step 1
Challenge your students to design and make a model/map of a small town of a few thousand people where they would like to live. Have your students work in teams of four to six students. Help them make a list of things they should include: houses, farms, stores, parks, lakes, open space, industry, etc.

Step 2
Distribute the materials and start the designing and mapping.

Step 3
When all teams are finished have each team share its design and compare results.
Q: How different/alike are students' own communities to the designs?

Step 4
Challenge your students (ham it up) to decide how they are going to suddenly add an extra 1,000 people to their town if new industry moves in, population growth, etc. Send your students back to their map/models to redesign.

Step 5
Discuss the changes the students made.
Q: Where did they put extra homes and shopping areas?
Q: Are services, such as electricity, adequate?
Q: If farming or open space/recreation are lost, where will the population go to satisfy these needs?
Q: What would be the effects on oceans if your town were located near a beach or along a river? How sensitive to on-shore population growth is the nearby ocean?

FOLLOW-UP
Contact the local planning department to find out what changes they anticipate making as their own town grows. Debate a "no growth" ordinance.

BASEBALL BUSINESS

DESCRIPTION
Students inventory all of the materials and energy sources needed to play baseball. They trace these to their sources and make some value judgments on the game as it is played today.

OBJECTIVE
B-2. To understand how technological development and industrial expansion have contributed to the development of the modern day megalopolises in all parts of the world.

PURPOSE
To show that through technology we serve the entertainment needs of greater numbers of people than ever before.

Time Attendance at baseball game, plus 1 hour in class	**Where** Ballpark, classroom television
Topics Recreation, energy resources, environmental values	**Materials** Pencil, paper

ACTIVITY

Step 1
Assign the task of making a list of all the materials necessary to the playing of baseball. Such a list might include such things as: baseballs (how many are used in a major league game?), bats, helmets, catcher's protective gear, uniforms, umpire's gear, ball and strike counter, scoreboard, chalk, bases, lights, pitcher's rubber, gardening and landscaping equipment, etc.

continued

Step 2
Have them list all of the things which the fans use to make the game more interesting and more fun. This list might include radios, hot dogs, peanuts, beer, cushions, blankets (at Candlestick Park!), programs, pennants and souvenirs, etc.

Step 3
Have them list all of the uses of energy at the ballpark. This list should include transportation for the crowd to and from the stadium, energy to cook and heat food, lights, gasoline for the ground crew's equipment, and the energy needed in the manufacture of baseball equipment, etc.

Step 4
Discuss:
Q: What things on your lists could be eliminated without harming the game or the enjoyment of it?
Q: Do you think baseball is too complicated? Was it ever simpler than it is now?
Q: In the old days there were no lights, no giant stadiums, no sound systems, no beautiful lawns or artificial surfaces. The gloves were simpler and there were no batting helmets. Do you think major league baseball was better then or now? Why did it change?
Q: Do you think that the tremendous expenses involved in playing baseball nowadays are worth it?
Q: All professional sports cost a tremendous amount of money. Are there better ways in which our society can spend these monies?
Q: How important are spectator sports to Americans?
Q: How important is recreation to you?

FOLLOW-UP
1. Research the history of major league baseball in California. Where did the Dodgers, Giants, A's, Angels, and Padres come from? How long have they been in existence? What were some of the minor league teams which were replaced by the majors?
2. Assign readings from the *Boys of Summer*, by Roger Cahn.

ENERGY AT HOME

DESCRIPTION
The students inventory the energy-using aids and appliances in their homes. They then consider each energy user and judge it according to how essential they feel it is in their lives.

OBJECTIVE
B-3. To understand how individual and societal values and ethics influence the design of different types of built environments.

PURPOSE
To discover the various uses for energy in their homes; to judge each use of energy (need vs. convenience); and to pool class information to look for trends in values associated with energy use.

Time	Where
½ hour homework 2 one-hour class sessions	Home, classroom
Topics	**Materials**
Energy, consumer ecology, environmental ethics	None

LEAD-UP/PREPARATION
Tell the students that increasing numbers of people are using more and more energy to provide for the needs and conveniences of their families. In California most of that energy is electricity and natural gas. But the energy sources presently being used are not going to last forever. Changes in people's attitudes about how energy is used can make more energy available for their needs.

ACTIVITY

Step 1
Tell the students that the first piece of energy information they need to have is how energy is used in their own homes. Tell them that their homework assignment is to survey their home to discover how many energy-using appliances they have. They should list, by room, all of the appliances found in their homes. Allow several days for all inventories to be completed. Don't forget the energy required to heat water in the home.

Step 2
When the inventories are completed and returned to class, tell the students, "We're all going to find out something about how the class *feels* about the uses of energy in the home." Ask your students to put a check mark next to each appliance they can *do without easily.*

Step 3
Let the students rate their *energy dependence* by following this formula:

- Add up the total number of energy-consuming appliances you have in your home.
- Divide that number by the number of appliances you can do without easily.
- This is how you should rate yourself—if the answer to the division problem is:
  1 = potentially totally energy independent (If you have 23 items and can do without 23 of them, perhaps you should!)
  between 1 and 2 = energy conservative
  between 2 and 4 = moderate energy dependence
  over 4 = energy dependence (the higher the number the greater the dependence). Rethink the question of what you can do without.

FOLLOW-UP

Discuss these issues:

1. What is the difference between an energy need and an energy convenience?
2. If populations of people continue to grow, what might change in the way people use energy?
3. What changes could you make at your home right now to conserve energy?

POP YOUR CORK

DESCRIPTION

Students perform an experiment with yeast to show that biological functions require energy and that there is a loss to the system in the form of heat and work.

OBJECTIVE

C-1. To understand that continuing supplies of energy are essential for maintenance of life in both natural and built environments.

PURPOSE

To show that there is a flow of energy through natural processes.

Time	Where
1 hour	Classroom
Topics	**Materials**
Energy; technology, scientific methods, plants	For each group of three: test tube, cork stopper, package of yeast, warm water—approximately 115° F (45° C), sugar, Vaseline

LEAD-UP/PREPARATION

Gather the materials listed and divide the class into lab-work groups of three students.

ACTIVITY

Step 1
Crumble the package of yeast between your fingers into the test tube. Add enough warm water to fill the test tube three-fourths full. Add one-fourth teaspoon sugar to the test tube. Smear Vaseline on the cork stopper and plug up the test tube. Observe the following reaction: as the yeast cells use the sugar, it produces a gas. Soon you should notice bubbles of gas forming. As the gas is produced, it presses against the sides of the tube and the cork. As the pressure gets higher, the cork should pop off (the gas is CO_2).

continued

Step 2

Q: What has happened to the cork? Why?
Q: Why did we place Vaseline on the cork? Did it serve its purpose?
Q: Was any "work" performed by the cork? Where did the energy come from?
Q: What helped the yeast cells obtain their energy?
Q: What kinds of things do you do that burn up energy?
Q: Is your body working while going through its digestive process? Is this using energy?
Q: How do you supply your body with the energy it needs?
Q: Can you think of another example showing a loss of energy during a transfer of energy?
Q: Where is energy lost in a food chain as opposed to the energy being transferred?

Give another example of a food chain showing transfer and loss of energy. Name some examples of energy transfer and loss in:

- A water ecosystem
- A meadow ecosystem
- A mountainous ecosystem
- A desert ecosystem
- An arctic ecosystem

Q: How will this energy loss affect an ecosystem?

FOLLOW-UP

Involve the class in using yeast to bake breads and cakes. Bake seasonal cookies. Follow all the processes with chemical formulas involving yeast action, change of physical and chemical states, and the transfer of energy. For example, the rising of dough is caused by the release of CO_2 gas as yeast metabolizes the sugars and starches in the dough. This can be shown by the equation

$$\text{sugar} + \text{water} \xrightarrow{\text{yeast action}} \text{alcohol} + CO_2 + \text{heat}$$

The alcohol evaporates off. The CO_2 is released in large quantities and is trapped in the dough as bubbles. Have your students check for the temperature rise caused by the heat released in this process.

Reference: Brandewein, Paul F.; Beck, Alfred D.; Strahler, Violet; Hollingworth, Leland G.; Brennan, Matthew J.; *The World of Living Things*. Harcourt, Brace, and World, Inc., 1964.

Adapted from Environmental Education Activities Manual

ROOM TO BREATHE

DESCRIPTION

Students draw pictures of what their dwelling places would be like if the availability of resources, space considerations, climate, etc., changed. They also use the language arts skills to convey their reactions to the changes.

OBJECTIVE

C-2. To understand how both built and natural environments are dependent on the continuous renewal of resources.

PURPOSE

To show that life and lifestyles depend on the environment, natural and built.

Time	**Where**
½-1 hour	Classroom
Topics	**Materials**
Human ecology, geography, economics	Drawing paper, crayons, markers, pencils

LEAD-UP/PREPARATION

"Our area of California and our community, in particular, are unique in the world. No other place has the same conditions of climate, availability of resources, geography, or mix of people that we do. What are the factors which make us so unique?" Sample responses may include—we have lots of flat land for farms here; we have people of Mexican descent, German descent, and Japanese descent; we have the river nearby, etc.

ACTIVITY

Step 1

Set up the following tasks for your students. Students may do one or more and may work individually or in small groups. Pick some that are more appropriate for your community.

Tasks

1. Draw a picture of what your house would look like if it had no wood, bricks, stucco, cement, adobe (choose one) in it.
2. Draw a picture of your house if the nearest house to it was only inches away.
3. Draw a picture of your street as it would appear if many of your neighbors used water conserving practices in gardening and landscaping; for example, if they used cactus and other desert plants, or local plants adapted to your area's rainfall. Draw a picture of your street if no landscaping at all was done.
4. Draw a picture of your classroom if there were twice as many students in your class as there are now. Or half as many as there are now.
5. Draw a picture of what your house would look like if you lived in Los Angeles; in San Francisco; in the Sierra; on the Mojave Desert; in the Klamath Mountains; in Mendocino; in the San Joaquin Valley. Pick one of the above places most dissimilar to your town.
6. Draw an imaginary house that would fit in the Sierra in winter and the Anza-Borrego Desert in summer, a convertible house that would keep you comfortable and well-sheltered no matter where you lived in California. You can also make it movable so that you could move it from one California environment to another.

Step 2

When the drawings are complete, ask your students to write a poem at the top of the drawing, describing how they would feel if they had to live in their newly-drawn dwelling or if they had to attend their newly-populated school.

Step 3

Display and discuss the class work.

FOLLOW-UP

1. Teacher can ask the students for anecdotes describing other places in which they have lived.
2. Compare a neighboring community to your own. What are the similarities and differences?

NICHES

DESCRIPTION

Students select a large building or complex of buildings to survey. They investigate the north, south, east, and west sides in search of any large differences in the plants growing in each location. If possible, they then compare their discoveries to the native plant community that the built environment replaced.

OBJECTIVE

C-3. To understand that built and natural environments are continuously interactive and changes in one area of the environment can cause changes in many other areas.

PURPOSE

To show that living and nonliving things (including built structures) affect one another.

Time	Where
½ hour	Area around a school building
Topics	**Materials**
Human ecology, plants, ecological niche	1 per team (3-4): outline map of building and surrounding area, action card (see below); 1 per class: large version of map

LEAD-UP/PREPARATION

1. Select a building site for the activity. Any kind of building is fine, but one in an open area is preferred. Results will be quite different depending on whether or not the perimeter of the building is gardened.
2. Prepare for each team of three or four participants and have available, one outline map of the building and the land around it. Also prepare one large outline map. The map needs to show only the outline of the building and any other significant nearby structures.

continued

3. Reproduce enough action cards for each team to have one card. Include some of your own that reflect features of the particular building you have chosen.

ACTION CARDS

- Find and mark on your map those places where plants seem to grow much larger than the same kind of plants in other places around the building. What, in each case, do you think is causing this?
- Find and mark on your map those places where plants seem to grow much smaller than the same kind of plants in other places around the building. What, in each case, do you think is causing this?
- Find and mark on your map those places where the number of plants in a small area is high. What, in each case, do you think is causing this?
- Find and mark on your map those places where the number of plants in a small area is very low. What, in each case, do you think is causing this?
- Find and mark on your map those places where no plants grow. What, in each case, do you think is causing this?
- Find and mark on your map the least common plant growing around the building. Are there any special conditions which permit it to grow in that place or places?

ACTIVITY

Step 1

Tell the class that it will be working in teams outdoors to discover how the school building influences the plants growing around it. Tell the class it will be trying to answer the questions on the action cards that will be distributed. Form teams and move outdoors. Each team needs a pencil.

Step 2

Distribute one outline map to each team and help the students orient the map to the building. Distribute action cards. Tell the students to mark the map carefully each time they find an example of the answer to the challenge question. Let them search around the building for fifteen minutes.

Step 3

Call the group together. Have it transfer its records from the small outline map to the large one. Results of each different action card should be recorded with a different color. Discuss what might have caused the observed results. Introduce the idea that environmental factors, such as moisture, light, temperature, wind, and human influence, might be responsible.

FOLLOW-UP

1. Reinforce the concept of environmental factors. Select one factor (temperature, moisture, light, foot traffic, etc.) and tour the building, observing how plants respond to that factor. Bring along your large map so you can compare the data gathered earlier to the influence of the various environmental factors.
2. Orient a building map according to the compass, and have participants hunt for evidence of differences in plant growth on the north, south, east, and west sides of the building. Can the students relate these differences to environmental factors caused by the building's exposure? What about the effect of gardening or the lack of it?
3. Try to find a nearby plot of native or unmanaged plant community. Compare what is found here to the built environment of the school building.
4. Interview the school gardener. Find out what management practices s/he uses on the plants around the building.
5. How are niches defined in other environments, for example, the beach, the intertidal, the near-shore marine?
6. What plants around your building are natives? Compare the amount of water needed by natives with the amount needed by introduced plants. Compare the amount of water needed by the plants around the building with the amount needed by the native plant community in a nearby area.

NOTES

Social Institutions and Decision-Making Activities

108

109

SOCIAL INSTITUTIONS AND DECISION MAKING

Issues

Western cultures have historically perpetuated two basic themes through their decisions affecting the environment. One is the concept that humans are dominant over nature, and therefore, free to exploit natural resources for their benefit. The other is a concept of stewardship — that humankind has a responsibility to protect all living things and the land, air, and water. The tension between these two themes is often apparent when environmental issues are debated.

Decisions affecting the environment are usually made within our social arenas. Responsibility for the "public good" is shared by political, legal, economic, educational, and religious institutions. An overview of these major social institutions helps clarify the role of each.

Government has played an increasingly influential role in environmental decision making. Enactment of the National Environmental Policy Act of 1969 (NEPA) established the process for giving environmental concerns consideration in governmental decisions. This act instituted the requirement of environmental impact statements, which mandate the consideration of environmental, as well as economic and technological, concerns in the decision-making process. Laws to control air and water pollution and to expand parks and wilderness areas have also legitimized the concern for a healthy environment. Lobbyists have been influential in shaping our government's environmental policy. Groups such as the Sierra Club, Friends of the Earth, and those representing the interests of developers research the issues and take their cases to governmental representatives. These representatives often listen closely to those with a vested interest in an environmental issue.

Our courts have also played a decisive role in the resolution of environmental issues. The environmental impact statements of NEPA resulted in many suits by environmental groups against federal agencies. In discharging their obligation to interpret the law, the courts have clarified the intent of several environmental statutes.

The business and industry sectors of society affect environmental decisions, not only through lobbying efforts, but through economic enterprises that exploit natural resources. A long-standing debate argues the ethical relationship between business and the environment. Should business be expected to voluntarily engage in practices that diminish its profits? Does business have a responsibility to serve the social good of the community? Business and industry have, without a question, a profound effect on the environment. Yet, whether or not their mechanism for making decisions should consistently include environmental considerations is still largely undetermined.

continued

Business and industry affect environmental issues from another perspective: that of the worker. Labor organizations have found that, in recent years, environmental concerns are sometimes in concert with our own. Labor and environmentalists lobbied together for a bill that regulates the use of toxic substances. A tension continues to exist, however, in situations such as the expansion of Redwood National Park. Labor worked hard against a decision to expand the park because it believed it would destroy jobs.

The wave of enthusiasm that accompanied Earth Day in 1970 led many people to believe that educational institutions would be able to provide citizens with the ability to make responsible environmental decisions. Educators have had a difficult time, however, defining environmental education and deciding where it fits into the school curriculum. Also, schools usually **reflect** societal trends rather than set them. It has, therefore, been difficult to establish a future's-oriented curriculum within the existing educational structure.

When religious institutions have participated in the environmental decision-making process it has been mostly through their educational mission. Church organizations such as The American Friends Service Committee have advocated for personal lifestyles that reflect a concern for the environment. Other efforts, such as the Interfaith Center for Corporate Responsibility, have attempted to push churches into a more active role regarding environmental decisions.

Environmental issues are clearly complex. They are directly influenced by a societal concern for economic well-being and the leadership provided by the major social institutions. Each of these institutions must be responsive to social needs and the environment as they work to make decisions that promote the public welfare.

Five concepts have been identified to develop student awareness of Social Institutions and Decision Making. The first addresses the international ramifications based on continuous use of technological/industrial mode. The second addresses (1) the basis for economic prosperity that can be established through more efficient use of natural resources, and (2) the effects that unlimited short-term prosperity can have on long-term goals for ourselves and for future generations. The third concept addresses decision making about the environment — who makes decisions and how they are made. The fourth concept addresses the identification of sources of information about environmental problems and the real and potential influences which they have in helping to resolve these problems. The final concept addresses the nature of the regulations which are now in effect for controlling use of the environment, how regulations are formulated, and the role of individuals in assuming responsibility for participating in the resolution of environmental problems.

NOTES

SOCIAL INSTITUTIONS AND DECISION MAKING

MAJOR CONCEPTS	OBJECTIVES
A. Environmental problems transcend political entities, state and national boundaries, and cultural differences.	1. To understand how technological advancement and industrial expansion throughout the world are creating massive changes in the environment that have worldwide effects. 2. To understand that population growth in all parts of the world is creating an unprecedented demand for the consumption of natural resources. 3. To understand how national self-interests and societal values and ethics influence international collaboration on environmental issues.
B. The goals for every society include economic prosperity which is based, in part, on the consumption of natural resources.	1. To understand that technology for recycling and renewing resources, developing new resources, and discovering alternative uses for existing resources is critical for maintaining and improving our health, welfare, and economic prosperity. 2. To understand how short-term and long-term effects can influence economic decisions related to the use of the environment.
C. Individuals and private groups within our society play important roles in developing public awareness of environmental issues and in monitoring public and private activities in relation to the environment.	1. To understand how interest groups express the values, ethics, and understandings of subgroups within our society. 2. To understand that interest groups are established to participate in the political process and to influence public policy and lawmaking.
D. Educational institutions and communications media are potential sources for the creation of public awareness of environmental issues.	1. To understand that communications media through reporting, advertising, and other programming can widely influence public attitudes about the environment. 2. To be aware that a variety of public and private organizations provide educational programs to influence public opinion about the environment. 3. To be aware of the various avenues which are available for individual expression of concerns about the environment.
E. Environmental law is intended to regulate use of the environment for present and future generations.	1. To understand that governmental agencies at state and national levels monitor the environment, make recommendations for laws, and monitor the implementation of the laws. 2. To understand that environmental laws reflect a great many factors, such as economic consequences to an industry, technological development, and short-term and long-term consequences for the environment. 3. To understand that the effectiveness of environmental law is dependent on the extent to which individuals and groups accept responsibility for the care of the environment.

SOCIAL INSTITUTIONS AND DECISION MAKING OBJECTIVES & ACTIVITIES

		K-3	4-6	7-9	10-12
CONCEPT A	1. To understand how technological advancement and industrial expansion throughout the world are creating massive environmental changes that have worldwide effects.	Students interview elderly people from the community.	Through demonstrations and discussions of air and water movement, students discover how pollution can travel from one place to another.	Students use math and map study to outline the impact of land development on wildlife populations.	Students brainstorm positive and negative effects of off-road vehicles (ORVs); Students create lists for the more responsible use of ORVs.
	2. To understand that population growth in all parts of the world is creating an unprecedented demand for the consumption of natural resources.	Students count the number of people in the last two generations of their families. They discuss populations and the need to share resources.	Students simulate how rich and poor countries try to provide for the basic needs of their citizens.	Students participate in a global meal where 1/3 of the group eats an American meal, and 2/3 eat a Third World meal.	In a simulation game, Malthusian principles are demonstrated.
	3. To understand how national self-interests, and societal values and ethics influence international collaboration on environmental issues.	Through artwork and discussion, students describe and examine attributes of groups.	Students compare the belief systems and resultant behaviors of a Native American group and early settlers.	Students consider several hypothetical public policy decisions on food production from disparate points of view.	In a simulation game, students act as a committee gathered from different nations to erect an environmental monument.
CONCEPT B	1. To understand that technology for recycling and renewing resources, developing new resources, and discovering alternative uses for existing resources is critical for maintaining and improving our health, welfare, and economic prosperity.	Students learn additional verses to the song "It's a Small World."	Students look at long- and short-term effects of choices they make in purchases. Alternative lists are brainstormed.	Students consider packaging and its effect on the environment. They take a poorly designed package and redesign it.	Students design a segment of one community and take into account economic, energy, environmental, and aesthetic considerations.
	2. To understand how the short-term and long-term effects of resource use can influence related economic decisions.	Students sort and examine classroom waste and recycle selected items.	Students devise other uses for common items in a format game.	Students discuss a fictional work related to the use and abuse of natural resources.	Students examine the pros and cons of packaging in the fast food industry and make recommendations.
CONCEPT C	1. To understand how interest groups express the values, ethics, and understandings of subgroups within our society.	Students sort themselves according to physical attributes and opinions.	Students make a list of appropriate behaviors in outdoor settings. They look at them from the viewpoint of various interest groups.	Students role-play a city council meeting in which they must choose to fund only one of three environmental projects.	Students design logos representing interest groups concerned with environmental issues.
	2. To understand that interest groups are established to participate in the political process and to influence public policy and lawmaking.	Students learn about and make models of endangered animals.	Students create a story from facts only with interest groups viewpoints attached.	Students design a coat of arms representing a citizen's group, governmental agency, etc., concerned with the environment.	Students read position papers put forth by groups on the issue of overpopulation of deer in a small California park.
CONCEPT D	1. To understand that communications media through reporting, advertising, and other programming can widely influence public attitudes about the environment.	Students play describing games to see how well they can communicate a simple message. TV ads are analyzed.	Students role-play different propaganda techniques and examine advertisements for bias.	Students collect energy ads, discuss their purpose and effectiveness, and then design an energy conservation billboard.	Students detail some of the techniques used in the media to influence thought and opinion.
	2. To be aware that a variety of public and private organizations provide educational programs to influence public opinion about the environment.		Students write an editorial on land use in a hypothetical locality.	Students analyze environmental education curriculum materials for bias and manipulation.	Students write for their own class, lesson plans reflecting the biases of selected interest groups.
	3. To be aware of the various avenues which are available for individual expression of concerns about the environment.	Students express their feelings about a forest environment through creative dramatics.	Students examine ways of expressing their environmental concerns and then actually "make a statement."	Students choose an issue and write a petition to bring about change.	Students use a model letter form and write to those who have power over an environmental issue.
CONCEPT E	1. To understand that governmental agencies at state and national levels monitor the environment, make recommendations for laws, and monitor the implementation of the laws.	Students examine a classroom problem and the effectiveness of rules.	Students inspect a map showing the land area designated as public parks and open spaces and identify the origins of these designated areas.	Students conduct a mock trial involving thermal pollution of a stream from a nuclear power plant.	Students hold small group meetings to prepare statements on the use of national forest lands for vacation homes.
	2. To understand that environmental laws reflect a great many factors, such as economic consequences to an industry, technological development, and short- and long-term consequences for the environment.		Students take part in a land use planning decision concerning a newly formed lake.	Students simulate an EPA hearing on the use of DDT on the spruce budworm.	Students collect information in a school survey to determine how their school functions, what the power structure is, and who makes the rules.
	3. To understand that the effectiveness of environmental law is dependent on the extent to which individuals and groups accept responsibility for the care of the environment.		Students attempt to equitably divide coastal waters out to a 200 mile (320 km) limit.	Students predict what would happen to a vacant piece of land in the community which was owned in common.	Students analyze the actions of individuals in the environment and make value judgments.

CURRENT AFFAIRS

DESCRIPTION
Through demonstrations and discussions of air and water movement, students discover how pollution can travel from one place to another.

OBJECTIVE
A-1. To understand how technological advancement and industrial expansion throughout the world are creating massive environmental changes that have worldwide effects.

PURPOSE
Students will learn that the earth's air and water move from place to place and that pollution can be spread via the movement of air and water.

Time	Where
30 minutes	Classroom (Optional: heat a body of water outdoors)
Topics	**Materials**
Air pollution, water pollution, environmental values	Globe, basin or jars of water or natural body of water

LEAD-UP/PREPARATION
Students should understand the water cycle.

ACTIVITY

Step 1

With a globe for reference, ask students:

Q: Do you think the earth's oceans flow from one place to the other or do they stay in the same place? Do you think, for example, that water from the Sea of Japan could ever get to the coast of California? Where do rivers flow? What happens when icebergs melt? Where does the water go?

To elicit understanding that water moves from place to place, demonstrate by dropping food coloring into jars of water or large basins. (Or you may use a natural body of water and broadcast popcorn; then watch it travel. Use only biodegradable and aesthetically harmless materials.)

Step 2

Q: Do you think the air moves from place to place?
Q: How do you know?
Q: How can you observe air moving?

Demonstrate movement of air by having students blow bubbles; observe dust particles in a stream of light; feel wind against their faces; blow on their hands, etc. To demonstrate how water transports other substances (both harmless and harmful) to plants, place a stalk of celery into a jar of water colored with plenty of food coloring. Check back in a few hours to see how the coloring has traveled through the veins of the celery. From this example, relate to students how water moves and transports substances throughout the ecosystem.

Q: Do you think the air we're breathing has been somewhere else?
Q: Do you think it will travel far away after it's been here?
Q: How does it get to where it's going?

Step 3

Q: What are the effects of air and water pollution?
Q: What do you think happens to industrial waste that gets dumped in rivers or oceans?
Q: If some of our industrial technology pollutes one place, how does it travel to another?
Q: If one country misuses harmful pesticides or pollutes its air, does it affect us?
Q: How do the things we do affect nearby neighbors? (noise, smell, etc.)
Q: How does our technology affect other countries?
Q: What can be done to prevent worldwide pollution?

FOLLOW-UP

Effects of Our Pollution

Set up an experiment: Plant two terraria with exactly the same plants as close to same size as possible. Growing conditions (light, water, etc.) should be kept constant with the exception that you will introduce to one terrarium the smoke of one cigarette daily. The cigarette can be smoked by sticking it into the end of an empty plastic bottle and squeezing (be careful—try not to breathe).

HEY, NO FAIR!

DESCRIPTION

Students simulate how rich and poor countries try to provide for the basic needs of their citizens and what happens when they cannot.

OBJECTIVE

A-2. To understand that population growth in all parts of the world is creating an unprecedented demand for natural resources.

PURPOSE

To demonstrate how the failure to meet the basic needs of people in different parts of the world contributes to political and economic instability.

Time	Where
½ hour	Classroom
Topics	**Materials**
Food/famine, environmental ethics	3×5 cards (see Lead-Up/ Preparation)

LEAD-UP/PREPARATION

Write "food" on 3×5 cards (number equal to one or two less than number in class). On the same number of cards, write "shelter materials".

ACTIVITY

Step 1

Divide the class into five or six groups; make one group have *only two* members. Tell each group to make up a name for its country.

Step 2

Tell students: *Each country* must try to get enough food and shelter for its citizens. *Each citizen* must have *one shelter card and one food card just to survive.*

continued

Step 3
The country with only two citizens is the only very rich one. Give that country ⅓ of the food and shelter cards. The citizens of this rich country must have three "food" and three "shelter" cards apiece to keep their standard of living the same as it has been.

Step 4
Distribute the rest of the cards to the other countries.

Step 5
Tell all the countries that they may trade "food" cards for "shelter" cards and vice versa, in order to maximize the number of citizens who survive.

Step 6
After 10-15 minutes of the countries trying to meet their needs, discuss what happened.

Q: How did the citizens of the poor countries feel toward the rich country? Toward the other poor countries?

Q: Who got the food cards in the poor countries? How was that decided? Was there any argument about it?

Q: What did the rich country do? Was there any argument among the two citizens of the rich country about how the food and shelter would be divided?

Q: How did the rich country feel toward the poor countries?

Step 7
Lead the students to recall how actual poor and rich countries try to provide for their citizens' basic needs. What happens in countries where there is a failure to provide for basic needs?

Step 8
Have each country list possible solutions to the problem and present them to the United Nations (panel made up of one person from each country).

FOLLOW-UP
Compare the diets of different countries.
List countries (research) which are poor. How stable are they?

123

BELIEF STATEMENTS

DESCRIPTION
Students compare two different belief systems (native American and early settler) and the behaviors that result from them.

OBJECTIVE
A-3. To understand how national self-interests and societal values and ethics influence international collaboration on environmental issues.

PURPOSE
Students learn about the relationship between belief systems and behaviors.

Time	Where
Varies—½ hour discussion	Classroom
Topics	**Materials**
Environmental values, cultural history	Large paper, marking pens

LEAD-UP/PREPARATION
This activity can be used in association with a unit on native Americans or other cultures.

ACTIVITY
Discuss:
In some countries (cultures, societies) possession of guns is illegal; in others it is legal. In some societies there are hunting laws; in some there are none. In some societies anyone has the right to walk through another person's land or field; in some countries there are trespassing laws. Some countries have national parks; some don't.

Q: What do you think might be the reasons for these differences?
"Let's take a look at two different cultures. (For example, the native American plains tribes and the western settlers—pioneers.) Let's research their beliefs, especially with regard to the environment."

Step 1
Have students make a chart about what the Indians and what the

124

pioneers believed about the environment, and what they did with respect to the land and the buffalo. An example is below:

Example:

	Beliefs	Behaviors
Plains dwelling native Americans	1. The earth is "mother." 2. People can't "own" land. It is for all the people.	1. Ceremonies to bring good hunting. 2. Killed only what they needed. Used all parts of the animal. 3. Nomadic, followed buffalo.
Settlers	1. People should use the earth. 2. People can claim land and own it. 3. The land and its resources will never run out.	1. Hunted for sport as well as need. 2. Claimed land, built fences. Settled in one place. 3. Often terribly wasteful, slaughtering for sport.

Discuss:

Step 2

Q: Can you think of examples of how other cultures are different from or like each other? (Especially with regards to the environment.)

Q: Can you think of some other groups in our country that have like/different beliefs and behaviors?

Q: Do *you* think that people's beliefs shape what they do? How do your beliefs shape your behavior?

Q: Do you think that people behave differently when they learn new facts? (For example, that a certain resource is running out.)

FOLLOW-UP

1. Find out about policies or attitudes of different nations with regard to wildlife, such as whales, harp seals, and eagles. Write letters to students in another country or research in other ways.
2. Find folk legends or songs from other cultures which illustrate some of the values of those cultures. (For example, "Peter and the Wolf" or Malvina Reynolds' song "The Whale.")

ENERGY CHOICES

DESCRIPTION

Students examine the long-term and short-term effects of choices they make in purchases. Alternative lists are brainstormed.

OBJECTIVE

B-1. To understand that technology for recycling and renewing resources, developing new resources, and discovering alternative uses for existing resources is critical for maintaining and improving our health, welfare, and economic prosperity.

PURPOSE

Students will learn that we have many lifestyle choices, and that the appropriateness of those choices varies with the situation.

Time	**Where**
1-2 hours	Classroom
Topics	**Materials**
Energy, environmental values, environmental impact, consumer ecology	Chalkboard, paper

LEAD-UP/PREPARATION

Discuss: We make choices every day. Many of our choices have an effect on the environment—some we see immediately as having a direct effect; others have indirect effects. Sometimes we choose to use a certain technology for convenience without looking at long-term outcomes.

continued

ACTIVITY

Step 1
Let's list some of the choices we make which have an impact on the environment.

Step 2
Let's list some of our alternatives as well.
Example: We often choose modern methods over more primitive ones.

Modern technology	*Alternative*
Gas heat	Wood stove
Electric appliance (e.g., pencil sharpener, electric knife)	Nonelectric appliance
Nonreturnable bottles	Returnable bottles
Throw-away packaging	"Bring-your-own" package
Gasoline engine cars	
Nuclear power	Solar energy

Step 3
From this list, select some examples, and as a group fill in a chart like this: (Teacher may need to supply some information, or draw it out.)

	Modern Technology	*Alternative*
Example:	Garage door opener	Open garage door ourselves.
Benefits	1. Saves time 2. Useful for handicapped people 3. Safety at night	1. Get exercise 2. Save money 3. Save fossil fuels
Consequences	1. Uses more energy to manufacture and to run 2. Creates jobs	1. Get wet in rain 2. Takes more time

127

Example:	Car	Bike
Benefits	1. Get there faster 2. More choice of when and where to go 3. Carry heavy loads 4. Comfortable	1. Get exercise 2. See the scenery 3. Breathe fresh air 4. Save money 5. Less pollution
Consequences	1. Air pollution 2. Noise pollution 3. Cost of fuel increasing 4. Parking problems 5. Takes energy to manufacture	1. Get wet when it rains 2. Takes more time 3. Can't carry large loads 4. Limited in range

Q: Do the benefits outweigh the consequences in either choice?
Q: Do the benefits of one choice show up as consequences in the other choice?
Q: In what situations would one choice be better than another?

FOLLOW-UP

What do you think of this?
Electric knife requires 20 times as much energy to manufacture as to run for one year. Electric can opener requires 17 times as much energy to manufacture as to run for one year. Garage door opener requires 50 times as much energy to manufacture as to run for one year. Garbage disposal requires 30 times as much energy to manufacture as to run for one year.

128

DEFUSE REFUSE

DESCRIPTION
Students devise other uses for common items in a game format.

OBJECTIVE
B-2. To understand how the short-term and long-term effects of resource use can influence related economic decisions.

PURPOSE
To show that a little creativity can go a long way towards solving much of our problem with solid waste.

Time	Where
15 minutes	Classroom
Topics	**Materials**
Recycling, renewable resources, solid waste	Pencils, paper

LEAD-UP/PREPARATION
Discuss: Our modern society has long had a tradition of use and waste, disposability, and landfill. Most of our potential landfill areas have been used and many problems (chemical pollution, groundwater pollution) have resulted from poor landfill practices. Novel solutions have to be found for our solid waste problem. One partial solution lies in personal and community recycling.

ACTIVITY

Step 1
Divide your class into teams of three to four students.

Step 2
Have your students look around the classroom and call out five items. List on the board vertically the first five you hear.

Step 3
Horizontally, forming a rectangular matrix with the vertical list, write "use areas," such as are in the example below.

Example

CALLED OUT ITEMS	USE AREAS			
	SCHOOL	OFFICE	HOME	RECREATION
1. Blackboard Eraser				Eraser Toss Game
2. Lunch Box		Supply Holder		
3. Scotch Tape Holder				
4. Plastic Bag			Small Toy Storage	
5. My Lunch				

Step 4
Teams are to fill in the matrix with alternate uses for the items pertaining to the use areas (see example). The first team finished wins a prize; or keep a running total over a week of the results of the competition. You may ask for only three or five solutions instead of a complicated matrix to keep the game quick and lively.

FOLLOW-UP
Visit a landfill site. Visit a recycling center. How much of our solid waste is being recycled now?

OUTDOOR MANNERS COLORING BOOK

DESCRIPTION
Students make lists of appropriate behaviors in natural settings. They look at them from the viewpoints, as they perceive them, of various groups concerned with the environment.

OBJECTIVE
C-1. To understand how interest groups express the values, ethics, and understandings of subgroups within our society.

PURPOSE
To show that different groups within our society perceive the environment in different ways and attempt to influence public thought on environmental issues.

Time	Where
½ hour	Classroom
Topics	**Materials**
Environmental quality, environmental ethics/values	Drawing paper, pencils, duplicating masters

LEAD-UP/PREPARATION
Initiate a discussion with your students on the effects human actions can have on the outdoors. You might begin by showing a film or reading aloud a story on behavior in the forest or public parks.

ACTIVITY

Step 1
List on the chalkboard or on a chart short statements which express the ideas of your students. Ask the students to suggest behaviors they would recommend. Examples are:
- Be careful not to litter. If possible, pick up any litter left by others.
- Use the trash can.
- Don't carve or abuse any living trees or plants.
- Respect all wildlife.
- Be careful with fire.
- Stay on the marked trail when asked.

Step 2
Ask each student to choose one statement and to draw a picture to illustrate it, and then to write the statement at the bottom of the picture. You can transfer the pictures with the accompanying statements to stencils and duplicate them. Help your students collate and staple the pictures together to make coloring books to share with other classes in your school.

Step 3
Have your students choose pictures from the coloring book which might have been drawn by a representative of:
- Sierra Club
- Forest industries
- Oil industry
- Greenpeace
- Dept. of Parks
- National Wildlife Federation

A preliminary class discussion outlining the activities and goals of these groups would be of help.

FOLLOW-UP
Share the coloring book with the above groups. Have your class monitor their responses.

Adapted from *Project Learning Tree*

TELL ME A STORY

DESCRIPTION
Students create a story from facts only, with viewpoints of interest groups attached. They compare their stories and make statements about interest groups.

OBJECTIVE
C-2. To understand that interest groups are established to participate in the political process and to influence public policy and lawmaking.

PURPOSE
To show that interest groups are involved in influencing public opinion and creating a forum for the open discussion of ideas.

Time	Where
1 hour	Classroom
Topics	**Materials**
Environmental ethics, water pollution, consumer ecology	None

LEAD-UP/PREPARATION
Ask your students how the story would change if *Snow White and the Seven Dwarfs* were told from the perspective of the Evil Queen, or how *Pinocchio* would be different if *Monstro the Whale* told the story. Ask them to take their favorite bedtime story or fairy tale and change it as if it were being told by the wolf, the giant, or the bear.

ACTIVITY

Step 1
Write the following statements on the board:
- The river is not as clean as it was ten years ago.
- The factory was built along the river five years ago.
- The factory owner says that he has not polluted the river.
- The population of the town has doubled over the last ten years.
- Half the town works in the factory.

Step 2
Divide your class into five small groups, as follows:
Group 1 represents the factory owner.
Group 2 represents the fish in the river.
Group 3 represents a local resident who works in a factory.
Group 4 represents a local resident who does not work in the factory.
Group 5 represents a local environmental group.

Step 3
Have each group write a story based on the bare bones statements as seen from the viewpoint of the interest groups outlined in Step 2. They may aiso do drawings or write poems expressing their assigned point of view.

Step 4
Each group shares its work with the rest of the class.

FOLLOW-UP
1. Ask your students to watch for groups that try to influence the way you think. Examples include television advertisers, industry, government, and citizens' groups.
2. Make an Interest Group Bulletin Board from magazine cut-outs.
3. Ask what interest groups do that is generally good for our society? What do particular groups do that may have bad long-term effects?

CONVINCE ME

DESCRIPTION
Students role-play different propaganda techniques and examine advertisements for bias.

OBJECTIVE
D-1. To understand that communication media, through reporting, advertising, and other programming, can widely influence public attitudes about the environment.

PURPOSE
Students will learn to recognize bias, persuasion, and propaganda techniques in media.

Time	Where
2-3 hours	Classroom
Topics	**Materials**
Environmental ethics, consumer ecology	Magazines, newspapers, brochures

ACTIVITY

Step 1
Discuss the meaning of bias. Demonstrate different kinds of bias through role-playing:
- *Omission of certain information:* Role-play an ad for cigarettes, stressing good flavor, a glamorous image, etc. Omit mentioning the dangerous health effects of cigarettes.
- *Emotional appeal:* Role-play an ad for a political candidate who promises more jobs for those unemployed.

Step 2
Have students cut out ads, editorials, and newspaper articles which exhibit these forms of bias. Categorize them by pasting them onto butcher paper charts, perhaps in Venn Diagram form. See example below:

Step 3
Have students answer the following questions about the various ads:
- *Why* was this ad written? What product or idea are they trying to sell?
- *Who* sponsored it?
- For whom was it intended? Kids? Parents?
- What do you think is *fact* in the ad?
- What facts seem to be left out?
- What is appealing (or unappealing) about this ad?
- Will the product or idea really do what it promises to do?
- Is this something you *really* need?
- What would life be like without it? Could you survive without it?
- What would persuade you *not* to buy it?
- What else should you consider before buying this product?

Step 4
Have students look for ads of products that affect the environment.

FOLLOW-UP

1. Students can make their own ads, commercials, or bumper stickers, or hold an auction. Have them consider what "gimmicks" or persuasion techniques they will use. (You may wish to use this rule: They may state facts and ignore others but may not say anything which is untrue.)
2. Have students look for billboards, television, and radio commercials, etc., which reflect bias and affect the environment.
3. Homework: For one week, watch television every night for an hour. List the ads you see. Which ones "turn you on"; which ones "turn you off"? Why? Describe types of bias you see in each.

ENVIRONMENTAL EDITORIALS

DESCRIPTION
Students write an editorial on land use in a hypothetical locality.

OBJECTIVE
D-2. To be aware that a variety of public and private organizations provide educational programs to influence public opinion about the environment.

PURPOSE
Students will be able to recognize techniques of propaganda and persuasion used in the mass media by various groups attempting to sway public opinion.

Time	Where
1 hour	Classroom
Topics	**Materials**
Land use, environmental ethics	1 copy of the Premise per student

LEAD-UP/PREPARATION
Premise: You live in Robertson, a small town where most of the people work for the local lumber company. The company wants to cut down some trees outside of town near a park where many local families go for picnics. The company promises to clean up the area when it has finished and to make some improvements at the picnic area, including building a better road to the area and building a small pond for swimming and wading. Some people feel that the whole place is beautiful and just fine as it is. They have formed a group to stop the lumber company. Opinion in town is divided.

ACTIVITY
Step 1
Ask students to assume the roles of local reporters on the newspaper, *Robertson Reporter.* The editor has asked you to write *two* editorials, or to draw two cartoons, one for and one against the lumber company plans.

Students should make their materials as convincing as possible. They may use any value-laden words or phrases which they believe will contribute to the effectiveness of their arguments. Other propaganda techniques, such as stating some facts and ignoring others, may be used, but students may not say anything which is untrue.

Step 2
After the editorials or cartoons are completed, share them in class to determine how choice of words, selection of facts, and other techniques were used to build a case for one viewpoint or another.

Step 3
Discuss.

Q: Did the value-laden words or phrases tend to clarify or cloud the issue?

Q: Did you notice any obvious omissions of significant facts in any of the most effective editorials? What were they?

Q: Have you recognized any of the opinion-molding techniques that you used also being used by the local media in newspaper, radio, or television editorials?

FOLLOW-UP
1. Given the base of information you have established in this hypothetical situation, if you lived in Robertson, would you support the lumber company or the citizens' group? Might your position be different if you lived somewhere else? Describe the bases for your response to each question.

continued

2. Are there other alternatives available for the picnic area besides logging or not logging? If so, how might the community conflict be resolved to the satisfaction of the company, the citizens' group, and the entire community?
3. Have students write environmental editorials on a subject concerned with the sea, e.g., the shipping industry, exploration for offshore mineral products, marine mammals, the sea otter vs. the fisheries, etc.

Adapted from *Project Learning Tree*

VOICING OUR CONCERNS

DESCRIPTION
Students examine various avenues for expressing their environmental concerns and then actually use one avenue to "make a statement."

OBJECTIVE
D-3. To be aware of the various avenues which are available for individual expression of concerns about the environment.

PURPOSE
Students will experience the process of expressing their opinions and of getting feedback from policymakers.

Time	Where
1-2 hours	Classroom
Topics	**Materials**
Environmental legislation, environmental values	None

ACTIVITY

Step 1
With students, brainstorm a list of all the possible channels we have available to us for expressing our concerns about the environment. If students have limited experience in this area, have them ask parents or telephone local officials to get ideas for their list. The list should include the following "ways of taking action":

- Letter writing to: Public officials
  Influential people
  Newspaper editors
  Friends

- Petitions
- Telephone, telegram—to public officials (policymakers)
- Rallies, demonstrations, picketing
- Posters
- Information tables at supermarkets, fairs, airports, banks, etc.
- Door-to-door campaigning
- Speaking at public hearings or debates

Ask students to note which of these methods they have observed in the community.

Q: Have any of these avenues of expression been used for environmental issues?

Step 2

Have students list as many of their own concerns about the environment as possible. Each individual student now selects a real environmental issue that is important to him/her and chooses a method by which s/he can express an opinion and get feedback. Each student should include the following information when expressing his/her concerns:

- What is the issue?
- What s/he thinks can be or needs to be done toward preventing/solving the problem.
- Why s/he holds this opinion about the issue.
- Request feedback from policymaker or citizen to whom this opinion/suggestion is being expressed.

Most public officials will answer questions put to them in writing. Have students share their responses. Students should be encouraged to follow the developments surrounding the issues they choose and try to determine what influences these developments.

FOLLOW-UP

1. To whom would you address a petition on the pollution of oceans and beaches?

ORIGIN OF URBAN OPEN SPACE

DESCRIPTION

Students inspect a map showing the land area designated as public parks and open space in their community and identify the origins of these designated areas.

OBJECTIVE

E-1. To understand that governmental agencies at state and national levels monitor the environment, make recommendations for laws, and monitor the implementation of the laws.

PURPOSE

To examine the origins of parks and open spaces with respect to the agencies which create and maintain them.

Time	Where
1 hour	Classroom
Topics	**Materials**
Urban ecology, land use	Community maps for each small group

LEAD-UP/PREPARATION

Ask your students to think about how much of the land in your community is designated as parks or open spaces.

Q: Is the most space devoted to houses, businesses, or open areas?

Obtain a large map of your community which shows clearly its boundaries or city limits and its public park lands.

continued

ACTIVITY

Step 1
Ask students to use the map to get a better idea of the total land area within their community's boundaries. (Students can measure its dimensions and use the map's scale to convert the figures to square miles, acres, square kilometers, or hectares, if they have the necessary math skills.)

Step 2
Then ask the students to consider the amount of community land set aside in established parks or open space for public use. Have them measure or approximate. Is it one-half of the community, less, a lot less, more, a lot more?

Step 3
Q: Do you consider this amount of land enough for community needs? More than enough? Not enough?

FOLLOW-UP

Ask your students to write or visit the appropriate city or county offices to find out the historic and political reasons why these park and open-space lands were allocated for public use. Was a percentage of the total community land set aside? Did public pressure play a part? Was zoning involved? Were the lands donated by private interests? Were they saved by chance? By forethought? Are there provisions for adding public parks and open-space lands if the community continues to grow and more such lands are desired?

Adapted from *Project Learning Tree*

143

GIVE AND TAKE (OR) YOU CAN'T ALWAYS GET WHAT YOU WANT

DESCRIPTION

Students will take part in a land use planning decision concerning a newly formed lake.

OBJECTIVE

E-2. To understand that environmental laws reflect a great many factors, such as economic consequences to an industry, technological development, and short- and long-term consequences for the environment.

PURPOSE

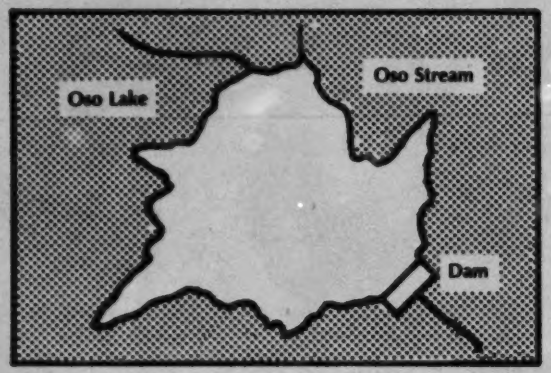
To show how compromises and trade-offs are part of environmental decisions or laws.

Time	Where
Two sessions 30-45 minutes 15-20 minutes	Classroom
Topics	**Materials**
Land use planning, environmental regulation, human ecology	Map of simulated lake area (see Lead-Up/Preparation)

144

LEAD-UP/PREPARATION

Make copies of a map or draw a large copy of the map below on chart paper or on the board.



ACTIVITY

Step 1

Present the following information to the class:
Oso Lake is a small lake in the national forest. It was recently created when a dam was built on Oso Stream. There are no roads to it, only trails. The Forest Service has to decide how the lake is to be used in the future. Three different groups of citizens have ideas. One group of citizens wants the Forest Service to lease the land to them so they can build cabins around the lake and a road to the lake. Another group wants to use the lake for fishing and the land around it for hunting. The last group wants the lake and the land around it set aside for a wildlife refuge. What should the Forest Service do?

Step 2

Divide the class into four interest groups:
1st group: Developers—People who want to build cabins around the lake.
2nd group: Recreationists—People who want to be able to hike into the lake to fish and hunt.
3rd group: Preservationists—People who want the lake designated as a wildlife refuge with no hunting or fishing allowed.
4th group: A U.S. Forest Service Advisory board—three to four members.

Step 3

Tell each group that it will need to prepare its testimony to present to the U.S. Forest Service Advisory Board, which will decide the fate of the lake and the land around it. Give the groups 15-20 minutes to do this.

Step 4

While the interest groups are preparing their testimonies, the Board should plan the hearing procedures. Who will testify first? For how long? In what order? Where will the board sit? The presenters?

Step 5

Hold the hearing when all groups are ready. Allow time for each group to have a rebuttal.

Step 6

Allow the Board to meet briefly to reach a decision.

Step 7

The Board will report its decision and give reasons for its decision.

FOLLOW-UP

1. Discuss with the students how the decision involved compromises. Ask the students for other possible compromises. List them on the board.
2. Ask the students how land use decisions are made in their own community. Any examples? New parks, industries, schools, houses, freeways?

WHO OWNS THE SEA?

DESCRIPTION
Students attempt to divide equitably coastal waters out to a 200-mile (320 km) limit, and discuss the advantages and disadvantages of doing so.

OBJECTIVE
E-3. To understand that the effectiveness of environmental law is dependent on the extent to which individuals and groups accept responsibility for the care of the environment.

PURPOSE
To show that environmental and commercial rights often infringe on individual rights and that law involves trade-offs.

Time	Where
1 hour	Classroom
Topics	**Materials**
Oceans, environmental regulation, fishes, natural resources	Globe, outline map of the world for each student

LEAD-UP/PREPARATION
Have the class discuss the concept that all countries feel the necessity and have the right to protect their borders. Do we want our borders protected so that we can't be invaded by an enemy country? What are some ways we do this? Should we also protect our borders along the ocean? How far out into the water should we have control? Discuss a 12-mile (20 km) limit (fishing rights, etc.). Let's see what would happen if every country declared a 200-mile (320 km) limit.

ACTIVITY

Step 1
On a map of the earth, have each student extend the boundaries of each country approximately 200 miles (320 km) out to sea. Note the many problems which occur when lines begin to cross or when narrow bodies of water begin to be "claimed" by many different countries.

Step 2
Discuss the pitfalls and benefits of a 200-mile (320 km) territorial limit for the United States. Divide the class into two groups. One group would represent the tuna fishers in other countries' territorial waters and out in the open sea. The other group would be fishers who take fish from our local waters within a 200-mile (320 km) limit, such as halibut, herring, and lobster. The tuna fishers, of course, will not want this limit, because if all countries extended their borders 200 miles (320 km), tuna fishers would be denied the right to catch tuna in many parts of the open sea. In contrast, our local fishers want to protect our coastal fish resources from exploitation by foreign countries. They will want to protect themselves, and they will also want to have the right to manage the resource wisely, making sure that too many fish are not taken. Which side do you think presented the best position? What did they do that made them superior? Does this mean that their side of the argument is right and that the other side is wrong? Can you think of any arguments that either side neglected to present?

FOLLOW-UP
Research the roles and attitudes of the following agencies with respect to ocean boundaries:
- U.S. Navy
- U.S. Coast Guard
- U.S. Immigration Service
- Department of Commerce

Adapted from *Wet and Wild*

NOTES

Energy and Environmental Resource Management Activities

ENERGY AND ENVIRONMENTAL RESOURCE MANAGEMENT

Issues

The ultimate goal of resource management in the present-day context is to increase the productivity of our environment to meet the needs of an expanding population. On the underside of that optimistic outlook there is another equally urgent goal to ensure our survival. One concept emphasized in the section of the Natural Environment is the importance of habitat for the survival of any species of wildlife. In this section, that concept is applied to the human race and particularly to those of us who share in that part of the planet called California.

We are all familiar with the type of resource management that results in building a dam to provide for a continuous flow of water to an urban area, or a public works canal that carries water to farmlands for irrigation. And most of us have experienced the need to conserve water or gasoline when there are shortages. But after the dam was built, we discovered that fish no longer came up the rivers to spawn, and when the farmlands were irrigated, we discovered that salinization due to poor drainage was reducing the productivity of the land. One attempt to control the environment and manage a single resource led to other problems and the need for managing other resources. When the water or gasoline shortage abated, we knew we were still vulnerable and our lifestyles could be affected almost any time by another scarcity. Along the path of these experiences, the meaning of resource management has changed from a one-problem approach to a holistic outlook and a tacit recognition that humans are, in fact, only members of a biotic team.

A holistic approach to resource management is based on the recognition of at least two realities about our environment. One is that the environment is infinitely complex and any system for managing its resources must take into account all the ramifications that ensue from any intervention into its operation. Another is that we are confronted with the reality that we are approaching the economic limits of nonrenewable resources such as oil and gas. We face the challenge of finding a new basis for continued prosperity and a satisfactory quality of life. The answer lies in an increased reliance on and caring for renewable resources, such as forests, fisheries, farm soils, and rangelands. Underlying this shift in emphasis is another recognition that our natural resources constitute our true wealth now and for future generations.

Four concepts have been defined for developing students' understanding of resource management. The first is concerned with conservation, one way in which the real supply of resources can be increased by consuming less. The second is concerned with renewing resources, the problems involved in establishing continuously renewing supplies of resources. The third is concerned with understanding past — and present-day models for resource management and the lifestyles that include this as part of everyday living. The fourth is a description of the model for resource management that is being developed in California through the state government. A selected number of resource management departments are described in terms of the long-range problems with which they are dealing. Their particular departments were selected because their long-range planning needs so clearly exemplify the range of environmental problems which our society, in general, is confronting. Other departments within the Resource Agencies are also described more briefly and a number of educational materials that are available from each agency are listed and described. Detachable, addressed postcards for ordering materials or requesting information from each department accompany the materials list.

ENERGY AND ENVIRONMENTAL RESOURCE MANAGEMENT

MAJOR CONCEPTS	OBJECTIVES
A. There are a number of historic and present-day models which can be used in developing resource management programs.	1. To understand how groups of people historically have managed scarce natural resources for their collective benefit. 2. To be aware of the key factors in the world today that have contributed to the decreased availability and quality of all natural resources.
B. Conservation is the most immediate way of increasing the real supplies of a natural resource. Conservation practices focus on more efficient uses of natural resources.	1. To be aware of the importance of non-renewable resources for maintaining our lifestyles. 2. To be aware of economic, legislative, social, and other means that can be used in promoting the conservation of resources. 3. To become aware of the potential for recycling and reclaiming resources.
C. Some resources are renewable and can be maintained so they will provide consistent and continuous supplies of resources as they are needed.	1. To be aware of the role of technology in renewing and recycling resources. 2. To understand that through technology, we expand the range of resources which we use in meeting our needs and desires. 3. To be aware of the complexity which often exists in resource management, especially when intergovernmental and intercorporational cooperation is required. 4. To understand the necessity of long-range planning for resource management in relation to the assessment of future needs.
D. Resource agencies and their departments maintain the productivity of our natural resources into the future.	See California State Resource Agencies section.

ENERGY AND ENVIRONMENTAL RESOURCE MANAGEMENT OBJECTIVES & ACTIVITIES

		K-3	4-6	7-9	10-12
CONCEPT A	1. To understand how groups of people historically have managed scarce natural resources for their collective benefit.	The teacher gathers and brings to class natural materials used by California Native Americans.	Students participate in a decision-making simulation game taking place on a wagon train.	Students are presented with situation cards describing a lifestyle from the past and present expectations for the future.	Students describe their attitudes toward natural resources from the viewpoint of persons in the distant past.
	2. To be aware of the key factors in the world today that have contributed to the decreased availability and quality of all natural resources.	Students simulate the effects of population growth.	Students monitor TV commercials and discuss how consumption patterns have changed over time.	Students study maps of an imagined wetland island. They note changes over time, and make recommendations for the development of the island along more environmentally sound lines.	Students research the changes which have occurred in local commute patterns since World War II.
CONCEPT B	1. To be aware of the importance of nonrenewable resources for maintaining our lifestyles.	Students monitor their classroom water use and take action to reduce water use.	Students conduct an energy audit of their classroom and discuss energy waste.	Students take a look at the air pollution problems of Los Angeles and determine ways in which Angelenos might improve the situation.	Students learn to read electric and gas meters. They do an energy audit of their homes.
	2. To be aware of economic, legislative, social, and other means that can be used in promoting the conservation of resources.		Students conduct a survey to assess attitudes and incentives related to recycling.	Students examine the bill which made the 55 miles per hour speed limit the law, its hows and whys.	Students state their opinions on the many "ways" to save a tree and rank them on effectiveness and desirability.
	3. To become aware of the potential for recycling and reclaiming resources.	Students make paper from used paper, cardboard and other materials.	Students choose a household container and research how it was made and what happens when it is "thrown away."	Students put together a picnic lunch with the minimum amount of unrecyclable materials, a "garbage free" lunch.	Students take a fact-finding trip to a local recycling center and interview the persons involved in the recycling effort.
CONCEPT C	1. To be aware of the role of technology in renewing and recycling resources.	Students take a short field trip to a Christmas tree farm or sales lot. Students make decisions about Christmas trees.	Students visit a lumberyard and interview a lumberyard worker.	Students make musical instruments out of forest materials.	Students learn how agriculture alters the biosphere and how much land surface has been altered by human activity.
	2. To understand that through technology, we expand the range of resources which we use in meeting our needs and desires.	Students examine their shoes, consider how shoes are made, and identify the variety of materials used.	Students take a survey of things at school, how these things got there and the fuel used for moving these.	Students learn rudiments of road map reading and discuss transportation in California, past and present.	Students design environmental, energy and resource management games requiring technological solutions.
	3. To be aware of the complexity that often exists in resource management, especially when intergovernmental and intercorporational cooperation is required.	Students plan and manage a classroom garden.	Students are each given control over one major resource. They negotiate with other students to get needed resources.	Students research episodes of California history concerned with resource management, such as The Great San Francisco Egg War.	Students discuss a hypothetical situation showing the trade-offs necessary to, and common in, resource management.
	4. To understand the necessity of long-range planning for resource management in relation to the assessment of future needs.		Students compare their "lifespans" to the "lifespans" of selected resources.	Students design a community emphasizing the relationship between the work place and the residence.	Students organize an expedition walking trip of 200 hundred miles (320 km) or more, using a systems approach to planning and problem solving.
CONCEPT D	See California State Resource Agencies section.				

WAGON TRAIN

DESCRIPTION
Children participate in a decision-making simulation game taking place on a wagon train.

OBJECTIVE
A-1. To understand how groups of people historically have managed scarce natural resources for their collective benefit.

PURPOSE
To explore how the availability of resources and their management have changed over time.

Time	Where
3-6 hours spread over 3 days	Classroom
Topics	**Materials**
Cultural history, environmental ethics, energy resources	Student's handouts (see below)

LEAD-UP/PREPARATION
Prepare Available Supply List and Trail Decisions (included here).

ACTIVITY

Step 1
"In 1843, more than 1,000 men, women, and children left Independence, Missouri, in the largest wagon train ever to cross the continent to Oregon. You, too, will soon join a wagon train and have adventures similar to many that those early pioneers had."

Step 2
Divide class into wagon trains, with approximately five-seven people assigned to each train. Allow groups to meet and determine each member's name, family, home, occupation, and livestock.

Name:	Bill Jacobs
Family:	Wife Mary, son Jack, daughter Ann
Home:	Pennsylvania
Occupation:	Farmer
Livestock:	Three oxen, two goats, and five cows

Step 3
Now each group must decide what supplies to take. Each group can carry only 1,000 bulk weight units (BWUs), so it must carefully select those items it will need on the trail and at its homestead.

AVAILABLE SUPPLY LIST

HOUSEHOLD ITEMS

- pair of candle sticks (2)
- bedding for 1 bed (12)
- 15 yards (14 meters) of material (12)
- baby cradle (15)
- bed pan (2)
- cooking utensils for family (4)
- lantern (3)
- clock (5)
- stool (8)
- 5 candles (1)
- set of dishes (20)
- woven basket (5)
- spinning wheel (25)
- mirror (10)
- match bottle and matches (2)
- cooking pan (6)
- bed (30)
- blanket (7)
- family Bible (5)
- Dutch oven (6)
- wooden bucket (5)
- coffee pot (3)
- butter churn (10)
- cooking stove (75)
- plants (10)
- butter mold (2)
- coffee grinder (6)
- loom (35)
- rocking chair (15)
- pitcher and bowl (10)
- chest for clothing (35)
- family heirlooms (20)
- rug (25)
- table and 4 chairs (50)
- piano or small organ (100)
- 1 gallon (or 4 liters) coal oil (12)
- needle and thread (1)

FOOD
- 50 lbs. of flour (50)
- 25 lbs. of bacon (30)
- 25 lbs. of vegetables (30)
- 5 lb. tin of fruit (8)
- 25 lbs. of dried beef (25)
- 15 lbs. of salt pork (20)
- 25 lbs. of Pinto beans (25)
- 20 lbs. of sugar (20)
- 5 gal. (or 19 liters) of vinegar (25)
- assorted spices (5)
- 25 lbs. of salt (30)

(1 lb. equals 0.45 Kg)

PERSONAL ITEMS
- hunting knife (3)
- powder horn (4)
- bag of clothing for 1 person (20)
- children's toys (8)
- guitar (6)
- fiddle (5)
- eating utensils for 1 person (2)
- family first aid kit (10)
- pistol (4)
- rifle (6)
- extra pair of boots (7)
- chaps (8)
- snow shoes (6)

MISCELLANEOUS SUPPLIES
- 50 lb. bag of seeds (50)
- chicken coop (12)
- wood box full of wood (25)
- extra keg of gun powder (20)
- wine press (25)
- 20 gallon barrel of water (60)
- saddle (25)
- feed for 1 pair of animals (30)

TOOLS
- pick axe (5)
- 100 feet (30 meters) of rope (6)
- hatchet (4)
- axe (7)
- shovel (7)
- 3-prong pitch fork (6)
- 2-man cross-cut saw (7)
- hammer (2)
- corn sheller (25)
- anvil (10)
- 4 steel animal traps (5)
- metal plow (40)
- large grinding stone (20)
- bellows for fire (10)
- vise (5)
- tool assortment (10)
- grain cradle (10)
- twine (5)
- axle grease (13)
- oxen yoke repairs (15)
- hoe (4)
- scythe (7)

Step 4

Have each student begin a diary about their experiences since leaving home; the diary should:
- Describe yourself, your family, your animals.
- Explain why you are going to Oregon.
- Tell about your last home, and your family's feelings about going west.
- Tell about your last job and what you expect to be doing once you reach Oregon.

Step 5

Establish Trail Decisions for each wagon train; group to analyze.

Step 6

Discuss resources used then and now. How do we meet needs such as food, water, shelter?

FOLLOW-UP

1. Research songs and tall tales of the westward movement.
2. Research one of the western trails and draw it on a large map.

Adapted from *PIONEERS*, published by Interact Co., 1974

continued

TRAIL DECISION 1

SITUATION: Two weeks ago your wagon train left Ft. Indeperdence and began the trip west toward Prairie Wells. Normally the wagon train stops there to water the stock and fill the water barrels with fresh well water. Since there has been little rain this spring, most streams have also been dry and water has been scarce. You and the rest of the members of your train have been looking forward to Prairie Wells' water.

Even though you were all tired when you finally reached Prairie Wells, you went directly to the wells to fill your water barrels and water your stock. But you were shocked to find 4 armed men guarding the wells. These residents of the small community of Prairie Wells informed you and the others that the water level was low. With water so scarce the once free water was now going to cost you $10 a barrel. Several people on the train said they could not afford $10 for even 1 barrel, but most people need 4 barrels (2 for themselves and 2 for their stock). Tired and discouraged, you return to your encampment just outside Prairie Wells to decide what to do.

_____

your real name

DIRECTIONS for pages 80 and 81

1. Examine the information at left.
2. Fill out the 5 Ws chart below: (List WHO is involved, WHERE the action took place, WHEN the action took place, WHAT the problem is and WHY it is a problem.)
3. Read page 81 carefully. This page contains possible actions for your wagon train to take to solve the problem.
4. After each action analyze what may happen if you take that action. Tell whether or not you favor the action. Explain why.
5. If you can think of a better action to take, write it in the ANOTHER ACTION box. Then analyze it as you did the other 4.
6. Write the best solution of all in the box at the bottom of the page. This solution might be 1 of the 4 given you, the 1 you thought up or a combination of several solutions.
7. After everyone is finished, you will meet with the other members of your wagon train in order to decide what action your train will take.

5 Ws

WHO
WHERE
WHEN
WHAT
WHY

TRAIL DECISION 1

(See directions in column 2 of page 80.)

Possible Actions	Analysis of Each Action
1 Because you need water and because you will not likely find much water between here and Prairie Crossing, you should agree to pay the $10 a barrel. You will share the water with those that cannot afford the $10.	
2 Since you need the water and can afford to pay the $10 per barrel, you want to pay. Those who cannot afford it will have to try to find their own water along the trail.	
3 You should not pay the ridiculously high price for the water. You should plan to move on the first thing in the morning and hope to find enough water along the trail to get you safely to Prairie Crossing.	
4 You want the water but cannot afford to pay $10 a barrel. You and the others should wait until dark, attack the guards and take the water.	

ANOTHER ACTION	

BEST ACTION	

COMMERCIAL COMMENTS

DESCRIPTION
Students monitor television commercials and discuss how consumption patterns have changed over time.

OBJECTIVE
A-2. To be aware of key factors in the world today that have contributed to the decreased availability and quality of all natural resources.

PURPOSE
To illustrate how our consumption patterns have been altered due to growth of technology.

Time	Where
3-4 hours spread over 1 week	Home Classroom
Topics	**Materials**
Consumer ecology, environmental values, cultural history, technology	T.V. (at home)

LEAD-UP/PREPARATION
Give the class the following homework assignment: Watch television commercials for one hour. Record this information:
- What product is being sold?
- What does the ad claim the product will do for you? Why do you need it?
- Does the product satisfy a "need" or a "desire"?
- Do you think people could buy this product 25 years ago? 50 years ago?
- What—if anything—did they substitute to meet that need or desire?

ACTIVITY
Step 1
Have the students bring information recorded on each television advertisement. (see Lead-Up)

Step 2
Sort products into those things that meet a "need" and those things that meet a "desire."

Step 3
Give each student information gathered on an advertisement from the "needs" stack and one from the "desires" stack and research how each product is made, what it is made of, and when it first went on the market. (Students may try writing the company.)
Q: What products from our "needs" stack were unavailable 25 years ago? 50 years ago? (Stress technology's role in creating new products.)
Q: How did people meet that need 25 years ago? 50 years ago? Was it considered a "need"?
Q: What natural resources are used to make the product? Were they also used to meet the same need 25, 50 years ago?
Q: Has use of any particular resources increased because of this product? Decreased?
(Repeat questions with advertisements that meet a "desire.")

Step 4
Try to establish a time line illustrating when products went on the market. Point out the flood of products on the market since World War II as a result of increased technology.

FOLLOW-UP
Students can interview parents to find out what everyday products were not available to them as children and what products they used instead to meet "needs" and "desires."

ENERGY AUDIT

DESCRIPTION
Students conduct an energy audit of their classroom and discuss energy waste.

OBJECTIVE
B-1. To be aware of the importance of nonrenewable resources for maintaining our lifestyles.

PURPOSE
To develop an awareness of energy use and waste in a built environment; to develop skills necessary for practicing conservation.

Time	Where
1 hour	Classroom
Topics	**Materials**
Energy, environmental ethics, human ecology	8"×11" (20×28 cm) maps of classroom (1 per pair); 1 large map of classroom, a picture of two thermometers and thermostat (1 per pair), thermometers (1 per child), colored stick 'em dots: 6 colors

LEAD-UP/PREPARATION
Prepare a simple 8"×11" (20×28 cm) map of classroom, including doors, windows, counter space, etc. Duplicate for each *pair* of students, or have students draw their own map. Prepare a larger replica of the classroom map--on butcher paper large enough for entire class to see. Write a key at the bottom (see Step 1).

Prepare a picture showing two thermometers and a replica of the classroom thermostat.

Prepare envelopes containing small colored dots (approximately ten each of six different colors), *or* pass out six different crayon colors to each pair.

ACTIVITY

Step 1

Allow the group to choose a partner. Distribute maps, sheet with pictures of thermometers and thermostat, envelopes of colored dots.

"How many of you have ever been on an Easter egg hunt before? Today we're going on an "energy hunt." We are going to look for ways that we use energy in our classroom: for heating and cooling, for light, for what else? We're also going to look for places where we are *wasting* energy: where warm air escapes, where cold air gets in, etc.

Before we begin our energy hunt, we need to decide how to show each kind of energy on our map. Let's decide what color will represent each kind of energy."

Make a group key; teacher puts dots on the big map while students place them on the small map.

Sample key:

red	• room heaters
yellow	• hot water faucet
green	• things run by electricity
blue	• where cold air gets in and warm air gets out

Step 2

After children have established a uniform key, allow approximately 20 minutes for pairs to fill in their maps. Be sure they understand to put a dot *on their map* wherever they find something listed on their key. As each pair finishes, give it two thermometers: one to put at what it predicts is the coldest place in the room, and one to put in what it predicts to be the warmest place in the room. Have pairs check the class thermostat and mark the reading on their picture of a thermostat.

Step 3

Regroup: Using the individual maps as guides, fill in the big map together to create an "energy picture" of the classroom.

Q: What kinds of things do we use energy for in the classroom?

Q: Where does warm air get out and cold air get in? What might we do to prevent this?

continued

Q: What are some other ways we could use less energy in our classroom?
Q: Examine the thermometers. Find the actual warmest and coolest places in the classroom. What makes it the warmest (coolest) spot?
Mark the highest and lowest temperature readings on the pictures of thermometers.

FOLLOW-UP

1. Bring in examples of simple energy-saving techniques: window shades, curtains, insulation, pipe insulation, weather-stripping, tree planting, etc.
2. Make "I'm An Energy Hunter" pins and distribute to class upon completion of Energy Hunt.
3. Ask the students to try the same activity at home—having parents help make the maps.
4. What are "oceanic" energy sources (tidal, thermal difference, waves, subsea petroleum)?

Adapted from Shaver's Creek, Environmental Education Center

170

ONE MORE TIME

DESCRIPTION

Students conduct a survey to assess attitudes and incentives related to recycling.

OBJECTIVE

B-2. To be aware of economic, legislative, social, and other means that can be used in promoting the conservation of resources.

PURPOSE

To examine attitudes toward conservation of natural resources and recycling.

Time	Where
Two 45-minute discussions and student survey as homework	Classroom; survey at home and around neighborhood
Topics	**Materials**
Recycling, conservation, consumer ecology	Survey form (see below)

LEAD-UP/PREPARATION

Introduce the survey form below to the group by having it answer the questions. Discuss changes in survey questions—additions, deletions, etc.—and interviewing skills.

171

ACTIVITY

Step 1

Have students survey at least three different people—friends, neighbors, or family members.

Survey Form

Q: Would you recycle newspaper? Glass? Tin? Other
Q: Would you recycle if you had access to a convenient recycling center?
Q: Would you recycle if you were paid for returning items?
Q: Would you recycle if it were the law?
Q: What else would encourage you to recycle?
Q: Which is more important to you about recycling?
- Saving money
- Reducing pollution
- Reducing the need for additional sanitary landfill sites

Step 2

Tabulate results on board. Discuss results of survey.

Q: What do you think is the most common attitude toward recycling in our neighborhood? How do people feel about recycling?
Q: What would get more people to recycle?
Q: Are there any steps we might take to promote recycling?

FOLLOW-UP

Bring in information on the issue of the returnable bottle vs. the no deposit, no return one. Discuss and debate.

Adapted from *Let's Recycle!*

HOLD IT

DESCRIPTION

Students choose a household container and research how it was made and what happens when it is thrown away.

OBJECTIVE

B-3. To become aware of the potential for recycling and reclaiming resources.

PURPOSE

To determine what raw materials are used to produce common items and to assess the environmental impact of their use.

Time	**Where**
3 hours	Classroom
Topics	**Materials**
Recycling, consumer ecology	Resource books, containers made of various materials (cans, bottles)

LEAD-UP/PREPARATION

Collect several containers with labels. Look over and modify "The Story of the _____" (see next page for appropriate grade level.

continued

ACTIVITY

Step 1
Distribute the following worksheet. Have each student choose a container to complete "The Story of the _____."

Step 2
Provide books and other materials to help students complete "The Story of the _____." Encourage parents and older students to help.

Step 3
Share and discuss completed stories.
Q: What raw materials are used to make containers?
Q: What containers have a negative effect on the environment?
Q: How could some containers be reused?

FOLLOW-UP

1. Survey products in a supermarket that are made from recycled materials.
2. Visit a company that makes containers. Interview it with questions from "The Story of the _____."

Adapted from *Let's Recycle!*

THE STORY OF THE _____

I am a(n) _____container. Please tell my story by finding answers to the following question:

1. What do I look like? Draw me.
2. Why do I have a label?
3. What are some of the things I am used for?
4. What am I made of?
5. Where do my manufacturers get the raw materials to make me?
6. Are large amounts of my raw materials available?
7. How many years will my raw materials probably last?
8. Is there any pollution of the land, the air, or the water when companies extract my raw materials from the earth? If so, how?
9. How do manufacturers change the raw materials to make me?
10. Does the changing of my raw materials cause pollution of the land, the air, or the water? If so, how?
11. Am I thrown away after I am used?
12. What chemicals are released when I am burned? Are they harmful if released into the environment? Can they be filtered and disposed of properly?
13. Do I break down into earth again if I am buried? If so, how?
14. Do I disintegrate if I am thrown into a river, lake, or ocean? If so, how?
15. What are some ways in which I could be reused?
16. Can I be recycled? Am I recycled? Where am I recycled?
17. What happens to me when I am recycled?
18. Can I be safely burned to produce energy from the heat?
19. Who pays the real cost for manufacturing and disposing of me?
    - The manufacturer who makes me?
    - The company which uses me?
    - The consumer who buys me?
20. Who is responsible for disposing of me? Who pays the cost for disposal?
21. Do you think I am a good container? Why or why not?

INTERVIEW A BOARDWORKER

DESCRIPTION
Students visit a lumberyard and interview a lumberyard worker.

OBJECTIVE
C-1. To be aware of the role of technology in renewing and recycling resources.

PURPOSE
To acquaint students with an industry that depends on the renewal of a natural resource.

Time	Where
3 hours spread over 3 days	Classroom and visit to a lumberyard
Topics	**Materials**
Forests, renewable resources, careers, resource management	Interview question sheets: 1 per student

LEAD-UP/PREPARATION
Make arrangements for the class to visit a local lumberyard. Ask that an employee be available to answer questions.
Have the students prepare questions they want to ask the employee. Add questions you wish students to ask: compile an interview questions sheet and make a copy for each student.

Sample questions:
1. What kinds of trees did the boards come from?
2. Where did the trees grow?
3. Are the trees cut into boards at the lumberyard? If not, where?
4. How far are the logs (or lumber) hauled?
5. How do you make sure there is a steady supply of wood?
6. Has the price of lumber changed over the past few years? Why, or why not?

ACTIVITY

Step 1
Upon arrival at the lumberyard, allow the group approximately 15 minutes to explore:
Q: How many different kinds of wood can they find?
Q: What different textures, smells do different kinds of lumber have?

Step 2
Meet with an employee. Interview and record answers.

Step 3
Return to classroom. Discuss information gathered from interviews.
Q: Are all resources renewable? What do renewable and nonrenewable mean?
Q: What resources are not renewable?
Q: What other industries depend on a renewable source?

FOLLOW-UP
The lumber industry depends on a renewable resource. Invite a speaker to your class from an industry that depends on a *non*renewable resource.

Adapted from Project Learning Tree

SURVEY: HOW IT GOT HERE

DESCRIPTION
Students take a survey of things at school, how these things got to school, and the fuel used for moving them.

OBJECTIVE
C-2. To understand that through technology, we expand the range of resources which we use in meeting our needs and desires.

PURPOSE
To demonstrate the range of resources we use to meet our needs and desires.

Time	Where
45 minutes	Classroom
Topics	**Materials**
Energy resources, consumer ecology, fossil fuels	1 survey sheet per child (see below)

LEAD-UP/PREPARATION
Prepare a survey sheet for each child:

SURVEY SHEET

Things at School	How You Think it Got to School	Kind of Fuel Used for Getting it to School

ACTIVITY

Step 1
Brainstorm a class list of things at the school, such as:

pencils	butterflies	paper	food
paint	teachers	pets	students
chairs	balls	flowers	buildings
trees	chalk		

Step 2
Give each student a survey sheet. Instruct students to list all or some of the items from the brainstorming list under "Things at School." Now challenge them to fill in the rest of the survey sheet (try one together first).

Step 3
Go over selected items on the survey sheet, discussing how the items got to school and the fuel used in getting them to school.
Q: What things used fossil fuels? (Fossil fuels are gas, diesel, coal, natural gas.) Count these things.
Q: What didn't use fossil fuels? Count these things.
Q: Do the things on our list use more fossil fuels or nonfossil fuels? Compare totals.
Q: If we had no fossil fuels, what might we use instead of _____ ? Name an item transported by fossil fuel.
Increased use of fossil fuels has increased the number of things we transport from far away and decreased our dependence on things that grow or are made nearby.

FOLLOW-UP
Q: Where do fossil fuels come from?
Q: How are they transported?
Q: Where are they stored?
Q: What else are they used for, besides the things on our survey sheet?

Adapted from Spaceship School

WHAT'S MINE IS MINE

DESCRIPTION
Students are each given control over one major resource. They negotiate with other students to get other needed resources.

OBJECTIVE
C-3. To be aware of the complexity that often exists in resource management, especially when intergovernmental and intercorporational cooperation is required.

PURPOSE
To discover that resource management is complex and often requires negotiation and cooperation among nations and agencies.

Time	Where
2-3 hours	Classroom
Topics	**Materials**
Plants, ecological niche, human ecology	Butcher paper, crayons

LEAD-UP/PREPARATION
A discussion of the following resources and what they are used for would be helpful:

wood	coal
oil	uranium ore
natural gas	hydroelectric power

Stress that most nations use *several* resources, not just one.

ACTIVITY

Step 1
Divide the class into six groups; each group controls the entire supply of one of the above resources.

Step 2
Ask each group to meet and discuss how it would use its monopoly of one resource to exert influence or power on the rest of the world.

Step 3
Ask each group to design a butcher paper display to show its plan for exerting power and influence. Have each group presents its plan to the class.

Step 4
Discuss apparent conflicts.
Q: How might they be settled? (war, negotiation, trade, etc.)

Step 5
Choose one member from each group to represent its interest in a debate. Have the representatives try to work out conflicting positions as group members observe. Allow time for representatives to confer with other groups.
Q: What happens if conflicting plans cannot be resolved in committee?
Q: What *other* resources might a nation substitute for those it cannot obtain?

FOLLOW-UP
There are many reasons why nations have gone to war. The need for resources is almost always included in those reasons. Find out what resources people fought for in the following U.S. wars:

- Revolutionary War (land in the West, trading rights)
- Spanish-American War (tropical goods, military bases)
- Civil War (commercial freedom, maintenance of slavery)

LIFELONG ADVENTURE

DESCRIPTION
Students compare their life spans to the "life spans" of selected resources.

OBJECTIVE
C-4. To understand the necessity of long-range planning for resource management in relation to the assessment of future needs.

PURPOSE
To demonstrate that many of the earth's resources are exhaustible and, therefore, long-range resource planning is required.

Time	Where
1 hour	Classroom
Topics	**Materials**
Conservation, energy resources, human ecology	Energy Resource Lifelines worksheet (included)

LEAD-UP/PREPARATION
Practice making time lines:
- Of your life from birth to now; of advances in technology, inventions, from 1920 to now, etc.

Define "depletion," "conservation."

182

ACTIVITY

Step 1
Distribute an energy resource lifelines worksheet. Go over codes "A, S, D, C," (see energy resource lifelines chart on next page).

Step 2
Instruct the students to mark each time line as follows:
- Mark your own estimated life span L.
- Mark the estimated life span of your children CH.
- Mark the estimated life span of your grandchildren G.

Step 3
Compare and discuss:
Q: Which energy resources will most likely be gone within your lifetime? Your children's generation? Your grandchildren's generation?
Q: Must energy be conserved during your lifetime, or do you feel that present generations should be free to use available energy resources at present rates?
Q: Do you feel that present generations have any responsibility for developing alternative energy sources for future generations?

FOLLOW-UP
1. Divide the class in half, and debate whether or not present generations should use as much available energy as they wish.
2. Draw pictures depicting two future scenarios—one with alternative energy sources and one with increased use of oil, gas, coal, and hydroelectricity.

183

ENERGY RESOURCE LIFELINES

COAL	A	S	X			D		C
	300 million years ago	200 years ago				in 100 years	in 500 years	in 2,000 years
NATURAL GAS	A	S	X	D	C			
	300 million years ago	160 years ago		in 20 years	in 50 years			
OIL	A	S	X	D	C			
	300 million years ago	110 years ago		in 20 years	in 50 years			
SOLAR			X		S			
As long as the sun and earth have existed					in 50 years			$4{,}200 \times 10^{15}$ watts available
NUCLEAR FISSION	A	S	X			D		C
	2 to 3 billion years ago	25 years ago			in 50 years	in 150 years		in 500 years
HYDROELECTRIC		A S	X					
		100 years ago						

Code: A = First Appeared on Earth
S = First Significant Use
D = Depletion at Present Rate
C = Depletion with Conservation
X = Present

184

185

NOTES

APPENDIX

SOURCES OF CLASSROOM ACTIVITIES

- **CAPTAIN HYDRO**
  Produced by
  East Bay Municipal Utility District
  P.O. Box 24055
  Oakland, CA

  Distributed by
  Office of Water Conservation
  Department of Water Resources
  P.O. Box 388
  Sacramento, CA 95802

  Captain Hydro is an upper-elementary workbook promoting water conservation. The student activities draw from many subject areas. East Bay Municipal Utility District has prepared Captain Hydro and other K-12 curriculum materials as part of Project Water.

- **CLASS PROJECT**
  National Wildlife Federation
  1414 Sixteeneth Street, N.W.
  Washington, DC 20036

  CLASS Project is Conservation Learning Activities for Science and Social Studies. These activities focus on environmental issues such as land use planning, solid waste management, and hazardous wastes. They are aimed at the junior high student.

- **ENERGY, FOOD AND YOU**
  Washington State Office of Public Instruction
  Office of Environmental Education

  Energy, Food and You is an interdisciplinary curriculum for secondary schools. It presents issues related to global food production and food-producing resources.

- **ENERGY LEARNING CENTER**
  Chevron USA, Inc.
  595 Market Street
  San Francisco, CA 94105

  The **Energy Learning Center** is a teaching unit aimed at introducing basic energy information and energy issues to students in grades 6-8. It is a

packet of 18 "fact sheets," a time line, a poster, a teacher's guide, and activity duplicating masters.

- **ENERGY AND MY ENVIRONMENT**
  Governor's Energy Office
  Tallahasee, FL 32301

  Energy and My Environment is a K-12 energy education curriculum in three teachers' guides (K-6, 7-9, 10-12). The activities are organized around seven conceptual schemes.

- **ENVIRONMENTAL EDUCATION ACTIVITIES MANUAL**
  Edited by William Stapp and Dorothy Cox (1974)
  30808 LaMar
  Farmington Hills, MI 49024

  This six-volume activities manual is designed to provide K-12 experiences that promote basic environmental education concepts. Each volume has activiites to (1) develop sensitivity toward the environment, and (2) recognize problems, develop problem-solving skills, and take action to solve environmental problems.

- **GREEN BOX**
  Environmental Education Program
  Humboldt County Office of Education
  901 Myrtle Avenue
  Eureka, CA 95501

  Greenbox is a kit containing student activity cards, teacher booklets, program philosophy, and rationale. It is an individualized program for grades K-8; each card gives three activities (K-3, 3-6, 6-8) for the same concept.

- **IOWA DEVELOPED ENERGY ACTIVITY SAMPLER (IDEAS)**
  Iowa Department of Public Instruction
  Grimes State Office Buding
  Des Moines, IA 50319

  IDEAS consists of six secondary (grades 7-12) curriculum guides (home economics, industrial arts, language arts, mathematics, science, and social sciences). The curriculum is multidisciplinary and centers on incorporating energy topics into these six curriculum areas. IDEAS is sponsored by the Iowa Energy Policy Council in cooperation with the Iowa Department of Public Instruction.

- **LAW IN AMERICAN SOCIETY**
  Journal of the National Center for Law-Focused Education
  Law In American Society Foundation
  33 North LaSalle Street, Suite 1700
  Chicago, IL 60602

  This journal is published four times a year. The February 1977 issue presents a series of articles about environmental issues.

- **LET'S RECYCLE!**
  U.S. Environmental Protection Agency
  Office of Water and Waste Managment
  Washington, DC 20460

  Let's Recycle is a booklet of lesson plans for grades K-12. These activities explore topics related to waste disposal. Each short activity description cites vocabulary and questions for discussion.

- **MANURE TO MEADOW TO MILKSHAKE**
  Hidden Villa, Inc.
  26870 Moody Road
  Los Altos, CA 94022

  Manure to Meadow to Milkshake is an experiential approach to helping students understand the interdependencies between their lives and the natural world. Although it is written by and for the Hidden Villa Environmental Project, it is full of easily adaptable activities, songs, plays, etc.

- **MARINE STUDIES IDEA BOOK**
  The Sea Grant Program
  University of Southern California
  Los Angeles, CA 90007

  The Marine Studies Idea Book is for grades K-6. It follows four central themes that cover the history, mythology, ecology, and politics of the sea.

- **OUTDOOR BIOLOGY INSTRUCTIONAL STRATEGIES (OBIS)**
  Lawrence Hall of Science
  University of California
  Berkeley, CA 94720

  Published by
  Delta Education
  Box M
  Nashua, NH 03061

  OBIS is written to introduce youngsters to basic ecological concepts through highly motivating activities. These activities are aimed at youngsters from 10-15 years of age, and are primarily oriented toward community-sponsored youth organizations and nature centers.

- **PERSONAL VALUES AND ENVIRONMENTAL ISSUES**
  by Donald Scherer
  Hart Publishing Company, Inc.
  New York, NY 10003

  This book describes activities that help clarify values related to environmental issues. It covers issues of pollution, energy, food, population, and land use. Groups are to examine these issues as they are guided through the process for making responsible decisions.

- **PIONEERS**
  Interact Co.
  Box 262
  Lakeside, CA 92040

  Pioneers is a simulation activity that involves students in making decisions on a wagon train. Students work together around problems encountered on their journey westward.

- **PROJECT LEARNING TREE (PLT)**
  American Forest Institute
  1619 Massachusetts Avenue, N.W.
  Washington, DC 20036

  Cosponsored nationally by the Western Regional Environmental Education Council, **Project Learning Tree** is a supplementary program designed to complement existing curricula. PLT includes two activity guides: one for grades K-6 and the other for grades 7-12 made available through workshops. For information on workshops and local facilitators, contact Project Learning Tree, c/o Salina Star Route, Boulder, Colorado 80302.

- **PROJECT WILD**
  Salina Star Route
  Boulder, CO 80302

  Project Wild is in its early formative stages, intended to be published in 1985. It will be a supplementary program designed to promote an understanding of wildlife. Project Wild is cosponsored by the Western Association of Fish and Wildlife Agencies and the Western Regional Environmental Education Council.

- **SCIENCE 5/13**
  Macdonald Raintree, Inc.
  205 West Highland Avenue
  Milwaukee, WI 53203

  The **Science 5/13** books are for teachers to help children from 5-13 years learn science through investigative techniques. The lesson objectives link closely to Piagetian stages of conceptual development.

- **SCORING THE LOS ANGELES LANDSCAPE**
  UCLA Urban Environmental Education Project
  University of California
  Los Angeles, CA 90024

  Scoring the Los Angeles Landscape is designed to help learners become attuned to urban ecology. Activities cover components of urban systems, such as air, energy, transportation, population, etc. These activities are appropriate for use by teachers of secondary students.

- **SHARING NATURE WITH CHILDREN**
  by Joseph Bharat Cornell
  Anada Publications
  900 Alleghany Star Route
  Nevada City, CA 95959

Sharing Nature with Children is a collection of nature-awareness games for anyone who spends time with children. The games are simple ways to help children know nature's ways. Some are purely sensory experiences, some explore ecological principles, and some are just for fun.

- **SHAVER'S CREEK ENVIRONMENTAL CENTER**
  Parks and Recreation Department
  The Pennsylvania State University
  University Park, PA 16802

  Shaver's Creek Environmental Center operates a nature center and a resident outdoor school program—both serve as a laboratory setting for PSU students. The resident outdoor program staff designed and field-tested appropriate technology curricula for grades 4-12.

- **SPACESHIP SCHOOL**
  Marin County Office of Education
  1111 Las Galinas Avenue
  San Rafael, CA 94903

  Spaceship School activities are designed for direct use by kids. Subjects covered are energy, air, water, food, transportation, environmental inventories, and environmental monitoring. There are two sets of Spaceship School activity cards, grades K-3 and grades 4-6. The trial edition was developed by the Marin Museum of Natural Science in 1978.

- **SUNSHIP EARTH**
  by Steve Van Metre — P.O. Box 288
  Acclimitization Experiences Institute — Warrenville, IL 60555

  Sunship Earth is an environmental education program for upper elementary students. It is designed for a residential setting and stresses understandings and feelings related to the natural environment.

- **THE NEW GAMES BOOK**
  The New Games Foundation
  P.O. Box 7901
  San Francisco, CA 94120

  The New Games Book is a starting place for those committed to the world of play. It exudes playfulness through creative, open-ended games. The only fast rule of New Games is "play hard, play fair, nobody hurt."

- **USE THIS**
  The Western Regional Environmental Education Council
  c/o Montana State Department of Education
  Helena, MT 59601

  Use This is a product of a joint effort between educators and resource managers. It describes techniques for examining curriculum materials available from resource agencies.

- **USING WILD EDIBLE PLANTS WITH CHILDREN**
  by Carolie Sly and Molly Whiteley — University of California
  School of Education (PDARC) — Berkeley, CA 94720

  Using Wild Edible Plants With Children introduces children to plant uses through hands-on activities. This packet consists of ten cards covering plants common to California.

- **VALUES ACTIVITIES IN ENVIRONMENTAL EDUCATION (ERIC)**
  The Ohio State University College of Education
  1200 Chambers Road, 3rd Floor
  Columbus, OH 43212

  Values Activities in Environmental Education presents activities for clarifying values related to environmental issues. The activities are for grades K-12 and are suggested for science, social studies, and language arts classes.

- **WET AND WILD**
  Marine Education Program
  USC Institute for Marine and Coastal Studies
  University Park
  Los Angeles, CA 90007

  Wet and Wild, a supplementary teacher's guide, is bilingual (English-Spanish), multidisciplinary, and contains ideas for classroom activities, background information, lesson plans, and references. It covers the physical ocean, ocean management, research, biological ocean, ecological ocean, and economic sea. The Marine Education Program also produces the Marine Idea Books for grades K-6 and 7-12.

California State Resource Agencies

California Coastal Commission
631 Howard Street
San Francisco, CA 94105

The Resource

The Coastal Commission, which includes one state commission and six regional commissions, was established by passage of a citizen initiative, Proposition 20, in the election of November 1972. The Coastal Commission was directed to do the following:

- Prepare a comprehensive, coordinated, enforceable plan for the orderly, long-range conservation and management of the natural resources of the coastal zone.
- During the planning period, to regulate development in coastal waters within a 1000-yard shoreline permit area to ensure that improper development would not undercut the plan being prepared.

The essence of the Coastal Plan is that the 1100 miles of California coastline should be treated not as ordinary real estate but as a unique place where conservation and special kinds of development should have priority. The plan is designed to achieve long-term protection and productivity of coastal resources in times of scarcity, as well as in times of abundance.

The Coastal Plan was completed and published in December 1975. Since then, the state and regional commissions have been overseeing the implementation of the Coastal Act of 1976 which grew out of the plan. Under this act, 67 coastal cities, counties, and four major commercial ports are required to develop local coastal programs which include land use plans and zoning ordinances. Once the Coastal Commission has reviewed and approved the plans, local governments will issue their own development grants. When all coastal communities have had their plans accepted, the Coastal Commission will be dissolved. Theoretically, all of these plans should have been completed by July 1981. However, at the time of publication of this Guide, it is anticipated that only one-half of the plans had been developed.

Long-Term Planning Needs

The Coastal Plan includes ten major categories with recommendations under each. These are described briefly as the long-range planning needs developed by the Commission.

Coastal Waters

Improve the productivity of the marine environment through control of overharvesting of marine life through stricter controls on dumping wastes into the offshore waters and through controlling the diking, filling, and dredging of coastal wetlands.

Coastal Land

Protect coastal streams and plan carefully for coastal watersheds by including provisions in local planning for protecting the quality of water feeding coastal wetlands, controlling sand supply and protecting spawning streams.

Retain natural habitat areas through acquisition, recreational controls and the regulation of adjacent development. Many plants, animals, birds, and marine creatures depend on the unique habitat provided by the coast and cannot survive elsewhere.

Encourage coastal agriculture through the alleviation of high property taxes and urban utility assessments, as well as through regulation of zoning and direct economic and technological assistance. The presence of the sea moderates the coastal climate, helping to extend the growing season and protect crops from frost damage. The rich alluvial soils in coastal valleys, combined with the temperate climatic conditions, create some of the finest

and most productive agricultural land in the nation.

Encourage sustained yields in timber production by amending laws to tax timber only as it is cut, rather than taxing the value of all standing trees. Conserve soil and mineral resources by requiring that local building and grading ordinances include effective measures to prevent erosion. Sand and gravel extraction would be barred in environmentally sensitive or highly scenic areas, and site restoration would be required where mining is permitted.

Protect coastal air quality by requiring the cumulative impact of development on coastal air quality to be considered in land use and transportation plans. Major pollution-generating developments, such as refineries, fossil fuel power plants, and freeways, would be excluded from portions of the coastal zone now designated as problem areas for the maintenance of air quality unless there were no more environmentally sound alternatives.

Coastal Appearance and Design

Protect the scenic beauty of the coast by providing guidelines for visually unobtrusive new developments that are subordinate to the setting and use materials that blend with the environment.

Coastal Development

Encourage orderly, balanced development by requiring that new developments be concentrated in areas where the environment can support them with adequate water supplies, sewer services, and adequate road and public transportation capacity. Already developed areas would be favored for new developments. In rural areas not containing significant natural resources, scenic value, or viable agriculture lands, first preference would be given to the development of low profile facilities to serve coastal visitors. Residential development would be restricted to places where other types of development were not feasible. Hazardous industrial activities, such as liquefied natural gas processing, would be limited to areas where several facilities would be concentrated.

Energy

The plan recommends that the Energy Commission have authority over the siting of new power plants and all other major energy facilities including those for petroleum and for power plants. Power plant sites would have to

be justified on the basis of no alternative sites, real need, minimal adverse visual impact, and, where feasible, provision of public coastal areas.

Offshore petroleum development would be permitted only if it is part of a national or western regional developmental plan. The plan also recommends revising current federal leasing practices to provide for withholding approval of offshore petroleum development until the exploration has determined the extent of the fossil fuel available and the environmental impacts from extracting it.

Tanker terminal construction would need to be justified on the basis of need beyond the existing facilities. Oil companies would be encouraged to trade oil supplies in order to reduce the need for new facilities and petroleum transport. Existing harbor areas should be used to accommodate Alaskan oil tankers with drafts of about 65 feet, and all other tankers should be restricted to deepwater terminals away from environmentally sensitive areas. Any new facilities would be developed for multi-company use.

Liquefied natural gas terminals would be restricted to a single operation until the public safety risks inherent in these operations are determined. If new terminals are built, they should be concentrated in already existing port areas.

Transportation

Limit adverse environmental effects of coastal access roads by improving the efficiency of already existing roads, promoting use of public transit, and paying special attention to weekend congestion problems. Coastal roads should include scenic parking areas, rest areas, beach access, and picnic grounds.

Provide for water and air transportation facilities within already existing port areas and avoid filling in wetland areas for this purpose.

Public Access to the Coast

Increase coastal recreation while protecting coastal resources through the location of parking areas that are away from the beach areas but with access. Where coastal communities are unduly burdened with providing visitor facilities, the plan recommends the use of state funds. Of course, all recreational areas would have to accommodate to the environmental capacity of the area to support tourism. Acquisition of additional recreation sites and encouragement of private developments to serve visitors is

recommended to meet the rising demand for use of the coastal zone as a vacation and recreation area.

Encourage recreational boating but protect wetlands by requiring that new or expanded marinas be built in natural harbors, in deep water that is not marsh or wetlands, and in areas dredged from dry land. Dry storage, rental programs, multiple ownership, and other means, are also proposed to provide for more boating while protecting the wetlands.

Scientific and Educational Resources

Protect sites of scientific, historic, or educational value through an intensified effort to identify and provide protection for the coast's historic and archeological resources.

Restoration

Restore degraded coastal areas with a program that would reduce the numbers of undeveloped coastal lots through purchases and consolidation of lots under common ownership. Purchases are recommended to protect areas useable by the public and in areas where costs of extending urban services would exceed the costs of buying lots.

California Conservation Corps
1530 Capitol Avenue
Sacramento, CA 95814

The Resource

The California Conservation Corps employs 1800 youth between the ages of 18 and 23 on a one-year basis, at minimal wage standards, to work in resource management projects throughout the state. After an initial 20-day training period, the corps members are assigned to one of the 25 CCC centers across the state. At these local sites they may work on resource management projects operated under the auspices of any of the departments within The Resources Agency. The corps is also used in conjunction with local, city, and federal projects. Sample projects include forestry clearance, tree plantings, developing urban parks, and fighting forest and chaparral fires.

The California Conservation Corps is always looking for new members since the work term is limited to one year. Anyone between 18 and 22 who is interested may apply through any local Employment Development Department operated by the state government.

California Energy Commission
1111 Howe Avenue
Sacramento, CA 95825

The Resource

In the early 1970s, California faced the challenge of runaway growth in the projected demand for electrical energy. Large numbers of new power plants were being proposed for construction to meet that rapidly escalating demand. By October 1980, however, California utilities had cut their estimates of the levels of demand in the early 1990s by more than half. In that same month, Southern California Edison Company, California's second largest electric utility, announced a new corporate policy of substantial commitment to conservation and renewable energy resources to meet its electric power needs. These developments and similar actions by the Pacific Gas and Electric Company signaled the end of the energy challenge of the early 1970s.

The formation of the California Energy Commission in 1975 was a major step in the state's response to unchecked growth in electrical energy demand. Since then, the Commission has been a national leader in adopting cost-effective energy conservation standards for new buildings and appliances. The Commission has also been a strong promoter of solar and other alternative energy resources. During this period, the California Public Utilities Commission and the state's electric utilities have redirected many of their efforts into conservation and alternative energy resource development.

Energy conservation provides an increase in the real supplies of an energy source. It represents more efficient use of existing supplies and a reduction in the environmental impact that always accompanies the expenditure of an energy source. In fact, energy conservation is equivalent to an increase in the amount of human well-being that can be extracted from the energy supply.

The notion of a decreased impact on the environment is critical. One of the fundamental misconceptions about the relationship between economic growth and energy consumption is that they are parallel and inseparable.

Successful conservation in a number of ways has shown that this relationship is not fixed and economic expansion is possible without increased expenditures for energy supplies and greater negative impacts on the environment.

Long-Term Planning Needs

There are essentially four approaches to energy conservation that have both short-term and long-range effects for our lifestyles.

Through improved technology and/or operating procedures, we can increase the efficiency with which we use the same amount of energy without any decrease in services. For example, many buildings use excessive amounts of energy for heating and cooling because of inadequate insulation. Similarly, different brands of the same appliance can use energy more or less efficiently. The use of smaller automobiles with less weight and improved mileage per gallon is another source of increased energy payoff. Reduced lighting and heating when commercial buildings are unoccupied can also bring about considerable savings in energy expenditures. In each of these examples, the energy savings are achieved with little or no decrease in the services supplied to the consumer, although, as in the case of smaller automobiles, the environmental impact can be reduced significantly.

Different modes can be used for heating and cooling, transportation, packaging products, and increasing the durability of products that extend the efficiency of the energy source.

Freight transportation is an important example of this type of conservation. Although railroads are much more energy efficient for the movement of freight, there has been a steady increase in the use of trucks for this service during the past two decades. Public transportation systems, deteriorating or practically non-existent in many communities, are vastly more energy efficient than the use of private automobiles. Increased durability of such products as the automobile and appliances can also contribute considerably to the long-range reduction of energy consumption. More efficient heating and cooling systems that require less expenditures of energy for the same effects are another source of energy savings. For example, electric heating is very inefficient from the standpoint of energy consumption. Similarly, solar energy used for heating water in residential buildings is much more energy efficient than the use of petrol[illegible]. The quantities of heat generated by petroleum are excessive for the amount of energy needed to heat water.

In another dimension, the energy required to manufacture throw-away glass bottles or plastic containers could be reduced through the more energy efficient use of returnable bottles.

The mix of goods and services within the economy can be changed to increase the contributions to income and employment per unit of energy used with some adaptations of our lifestyles.

For example, more sophisticated communication techniques can be substituted for business travel. Less pleasure travel can also be compensated for by a change of emphasis in leisure activities. Other types of motorized recreation such as trail bikes and motorboats can replaced by less energy-consuming activities such as hiking and sailing.

Changes in energy consumption patterns can be brought about through changes which impose restrictions on energy use that directly affect our lifestyles.

The clearest example of this type of energy conservation is the rationing of gasoline. Smaller residences that require less heating and cooling is another example. Car pools, reduced speed limits, and higher taxes on larger automobiles are other examples of how this more drastic form of energy conservation can affect our lifestyles.

The California Energy System of Today

Oil supplies most of the energy consumed in California.

- California uses 1.9 million barrels of oil per day, about 61 percent of the state's total energy use.
- Imports, principally from Indonesia, total 450,000 barrels per day.
- In-state production is the state's largest supply source.
- Transportation sector uses 62 percent of petroleum pro[illegible]cts.
- Federal price controls are being phased out in 1981.
- World oil prices increased 2000 percent in the last ten years.

Natural gas is California's second largest energy source.

- The southwestern United States supplies over half of the state's needs.
- About 73 percent of home energy used is natural gas.
- Some gas prices will be deregulated by January 1985.
- Only P5 (power plant) users have experienced major curtailment in recent years.

Electricity supplies only ten percent of California's needs.

- Due to normal generation losses, it uses about 25 percent of our fuels.
- Demand growth rates are decreasing.
- Half of California's power capacity depends on oil and gas as fuel. Power plants used 100 million barrels of oil in 1979.
- Electric rates are rising steeply due to high oil and gas prices and capital costs.
- Electric utilities are closely regulated at the federal, state, and local level.

Conservation is a growth area in the California energy system.

- California is a national leader.
- CEC building and appliance standards reduce energy use.
- Individual business initiatives produce most of the conservation in the commercial and industrial sectors.
- Utility load management reduces peak demand for electricity.
- The state is active in developing regional and intercity rail and bus transportation.
- Federal new vehicle efficiency standards have significant effects on Californians.

California leads nation in use of solar energy.

- The major current applications are solar heating of water and swimming pools, passive solar building design.
- The major government action is the 55 percent state tax credit used for 70,000 installations since 1976.
- The solar industry was a $150 million business in California in 1980.

California Energy Extension Service
1600 Ninth Street, Suite 330
Sacramento, CA 95814

California Energy Extension Service

The Resource

When Congress passed the National Energy Extension Service Act in 1977 to set up pilot programs in ten states, they recognized that a neighbor-to-neighbor approach to conservation information might be the "something different" that was urgently needed to convince Americans to change their attitudes, behaviors, and actions towards energy conservation. After all, if your neighbors are talking about conservation and doing something about it, then it's time for everyone on the block to join the conservation effort.

This personal delivery of conservation information is what makes the Energy Extension Service (EES) different from other programs that the U.S. Department of Energy supports. Through the program, Congress expects to gain a better understanding of the barriers to the adoption of energy-saving measures by small consumers and hopes to reduce the impact of fuel shortages and price increases on small consumers.

The California Energy Extension Service is a $1 million federally funded energy conservation action program of the Governor's Office of Appropriate Technology. EES contracts with established local organizations in communities across the state to provide effective energy management services for users of small amounts of energy who have not been adequately served by other federal, state, and utility programs.

Major Coordination Role

EES is charged with mobilizing the resources of people and their ideas, providing technical assistance, filling gaps, providing links between programs and people concerned with energy management, and promoting the use of energy-conserving practices by those programs not traditionally concerned with energy in California. This has led to a number of programs being jointly developed with other agencies.

Management Philosophy

EES is not a passive education or information program, but one engaged in active outreach with personalized, targeted delivery of energy information involving one-to-one contact with people.

Contracts are the mode of funding, not grants, to assure accountability and appropriate use of public tax dollars. Contractors must submit monthly reports and are closely monitored on a business-like basis to assure effective program operation. Evaluation is an extremely important part of each EES program and is used as a management tool by both the contractors and EES staff. Where problems and barriers emerge, programs can be fine-tuned and adjusted accordingly. Contractors are also brought together periodically for verbal debriefing and peer evaluation which has also proven to be an effective learning process and transfer of knowledge in itself.

The demonstrations EES funds focus on developing programs that are transferable to other groups in other locales so that groups interested in operating similar programs don't have to reinvent the wheel.

Energy Education Program

The Energy Education Program is designed for students, teachers, administrative staff and maintenance personnel, all of whom have a role in and responsibility for energy management within a school. This program will develop models for how these individuals' activities can be coordinated to save energy in schools and educate students about energy. To accomplish this objective, a four part program will be implemented: model demonstration contracts with local schools, teacher training sessions, a clearinghouse/resource center, and an evaluation of existing materials and delivery of services. This program is funded by monies from the Environmental License Plate Fund and operated in cooperation with the Department of Education.

Solar Installer Training

EES manages the SolarWork Institute, funded by the Employment Development Department. The Institute provides instructional materials and resource assistance to solar installer training programs operated by community colleges, union apprenticeship programs, and community-based organizations. The Solar Installer's Training Program Manual is being purchased and used widely by training providers, solar businesses, and the general public. Four training programs have been established with Institute assistance

Energy Management Contracts

In 1980, its first year, EES funded programs addressing six types of energy users. Major contracts developed demonstration programs in gasoline conservation, agriculture, and local government. The EES **Community Energy Program** negotiated 20 contracts of up to $40,000 focused on small business, tenants and apartment owners, and underserved populations. All of these focus areas will be continued in 1981, with the addition of energy cooperatives. Major focus areas include:

- **Renters and Apartment Owners**
  Nearly 45 percent of all Californians live in 4 million units of rental housing and many small businesses rent their stores and office space. It is an area of potentially large savings, yet existing federal, state, and utility programs have generally not provided cogent incentives for energy management investment in the rental sector. EES programs vary depending upon the conditions which affect the relationship between the landlord and tenant who is responsible for utility bills.

- **Underserved Populations**
  Certain client audiences are particularly vulnerable to the rising cost of energy. This category develops informational resources and provides assistance for those to whom information is often denied for a variety of reasons. Most of the clients served by these programs are low income, living in substandard housing in need of repair, unable to decipher documents, and perhaps senior citizens or rural residents. The resources and skills often exist within these "communities" to provide their own services, although they are often under utilized.

- **Small Business**
  More than 400,000 small businesses exist in California, each with its own set of problems. For many business people, energy management is not perceived as a critical or high priority issue. Energy costs have been seen as fixed costs, or ones to just pass on to the consumer. Front end costs are perceived as too high, payback is seen as too long, even if the return on investment is 200 percent, and the terms conservation and audits have negative connotations. In addition, the audience is diverse; commercial, retail, and small industrial. Many small business people rent or lease their business space.

  EES Model Energy Surveys in Santa Cruz showed restaurant managers, car dealers, and grocery store owners how to save 30-40 percent in

water heating, 25 percent in heating/cooling and ventilation, and 30 percent in delivery costs.

- **Energy Cooperatives**
  Neary 500,000 Californians are served by consumer cooperatives, many of these being food co-ops. In 1981, EES will be working with the National Consumer Cooperative Bank (NCCB) to create models of sustainable energy cooperatives. Energy co-ops enable consumers to pool their resources in an attempt to deal with the rising cost of energy. Co-ops can be formed to deal strictly with energy-related services and hardware, or these functions can be incorporated into the services provided by housing and food cooperatives. The EES is developing models for all three of these approaches and is investigating the possibility of energy producer co-ops, that is, nonprofit businesses that are owned and managed by the people who deliver these services. The EES money is to be used for technical and informational assistance and the staff and materials required to deliver these services. It is being supplemented by loans that will be paid back to the NCCB for hardware, inventory, etc.

Long-Range Planning Needs

- There is a need to build the capacity to sustain energy management programs and activities in local communities using local resources to meet national needs.
- There is a need to expand the marketing of targeted energy management information to reach tenants, apartment owners, homeowners, small businesses, women minority and ethnic populations, farmers, low income people, youth, and seniors.
- There is a need for better consumer information about:
  - energy conserving devices
  - energy management services, including contractors, energy auditors, shared-energy-savings firms, consultants
- Energy education needs to be infused through the curriculum with energy action programs at every school.
- Local funding of energy conservation and management programs through innovative financing mechanisms needs to be explored.
- Courses should be developed to update contractors and other professionals about energy-saving and alternative energy techniques in new and retrofit constructions for all sectors.
- Women and minorities need to be made aware of and encouraged to select careers in energy management and renewable resources. This extends from well-paying blue collar positions to those at the professional and managerial level.
- Energy management concerns need to be integrated into the comprehensive planning of each city and county.
- Attractive financing mechanisms for consumers and small businesses need to be further developed and expanded.

Department of Boating and Waterways
1629 S Street
Sacramento, CA 95814

The Resource

The Department of Boating and Waterways is the agency that provides service to the boating community in California. The authority to operate and provide services comes from the State Resources Code and the Harbors and Navigation Code. The 1100 miles of coastal waters, over 1,000 lakes and reservoirs, and thousands of miles of rivers are navigated by an estimated 2.5 million recreational boaters annually. Countless others use this resource for a variety of other activities.

The services provided by the Department of Boating and Waterways include development of boating facilities, beach erosion control,

environmental review, waterway planning, safety and education, enforcement, and yacht and ship broker licensing.

Long-Term Planning Needs

Develop and Preserve Public Boating Access

Recreational boaters and other aquatic participants require public access to the waters of the state. As land adjacent to the state's waters is developed by private interests and public access is limited, the need for the acquisition and preservation of public boating access becomes more important. The California Constitution, Article X, Section 4 states that without regard to the mode of aquatic use for any public purpose, the right of free and unabridged use of the state's navigable waters shall be maintained.

To assist the recreational boater in the use of public waters, the Department of Boating and Waterways develops public launch ramps, marinas, and other forms of access. These facilities are created to provide maximum enjoyment for the public with the least possible impact to the environment.

Conflicts Related to Access

The development of public access brings with it some concerns for environmental issues.

Conflicts that occur near the state's waters often include illegal trespass, litter, sanitation, and other similar problems. The acquisition of land adjacent to public waters can often **reduce** local conflicts. Where large-scale development means endangering riparian or wetland ecosystems, special efforts are made to minimize impact, or in come cases, enhance such areas.

Boating Safety

One of the most important functions of the Department of Boating and Waterways is promoting boating safety for the prevention of accidents, loss of life, and property damage. Assistance is provided to all statewide public boating safety courses offered by other agencies, such as Red Cross, U.S. Power Squadrons, U.S. Coast Guard Auxiliary, Scouts, YMCA's/YWCA's.

Educational services are provided to all public schools at a variety of grade levels. Films, coloring books, posters, and safety pamphlets are available without cost. Additionally, a complete high school boating safety course is offered. This course can be used as a separate offering, or as an element of another course. The materials for this course include textbooks, instructor guide, films, examinations, and handouts.

Department of Conservation
1416 Ninth Street
Sacramento, CA 95814

The Resource

As California's population grows, government planning at all levels for the use of land, now and into the future, is critical. Land use planning includes the recognition of geologic hazards (such as faults, landslides, coastal erosion) and other fundamental geologic knowledge (such as the location of mineral resources) which is related to safety and economic well-being of the citizens of California. To make these decisions wisely, planners need to tap different sources of information. Many of those sources are within the Resources Agency and several departments feed information into this process from the different perspectives of their expertise.

The Department of Conservation monitors the conversion of agricultural lands and administers the Williamson Act, a program that protects agricultural land that is in danger of being urbanized. In addition, the Department has an ongoing interest in the preservation and better use of soil resources. Data developed from these programs are made available to resource and land use planners to provide them with up-to-date information on which to base their planning.

The Division of Mines and Geology in the Department of Conservation has responsibility for collecting information about the surface and undersurface area of our landscape, including the location of earthquake faults and valuable mineral resources. Information about the location of mineral deposits is essential to the total picture that is needed in land use planning. Valuable mineral resources could be covered over by development and lost for use. Areas that are mined can be reclaimed for community use.

Two types of geological information are collected and disseminated by the Department of Conservation in the service of land use planning. One type focuses on a broad, general picture of the geologic structure and location of mineral resources throughout the state. Information of this type includes chartings of major earthquake faults. The data can

be used to map out broad geographic areas where it would be safe to situate critical installations, such as dams and power plants.

The other type of geologic information focuses on specific sites. Studies are undertaken to identify land movements within a small area in the case of making decisions for siting a dam and reservoir. Earth shifts are studied over periods of time and estimates are made about the feasibility of a structure withstanding the impact of any earth movements. Many studies on the subject of earthquake faults are conducted in conjunction with local communities throughout the state for this purpose. Other studies are conducted in cooperation with federal agencies as part of broad land use planning at the national level.

One avenue for dissemination of the information collected by the department is through advisory services to local, state, and federal agencies on a variety of topics such as environmental impact assessments and mineral resources development, as well as outer continental shelf development, and the reclamation of mined lands.

A second avenue for dissemination is through publications which include *California Geology*, a monthly magazine, and scientific research reports.

The Department's Division of Oil and Gas has the role of encouraging the wise development of the state's oil, gas, and geothermal resources in a manner that prevents, as far as possible, damage to life, health, property, and natural resources.

Long-Range Planning Needs

As the nation's demand for adequate and reliable sources of energy increases, so has the need for the wise development of our oil, gas, and geothermal resources. The development and use of alternative energy supplies is a vital and growing component of our total energy program, although petroleum fuels will play a major role into the next century.

Many inquiries about oil, gas, and geothermal development are received by the department. As part of a program to handle these inquiries in a thorough manner, a wide variety of publications and maps related to oil, gas, and geothermal operations are prepared and distributed by the publications staff of the Division of Oil and Gas. Among the publications are field articles authored by division engineers and manuals describing recommended field practices written for oil, gas, and geothermal operators. An *Annual Report of the State Oil and Gas Supervisor* contains statistical data including production, injection, and reserve figures. Oil, gas, and geothermal field maps are published with field boundaries, well locations, and some well data. All of these publications are either distributed free of charge or sold at nominal cost.

Department of Fish and Game
1416 Ninth Street
Sacramento, CA 95814

The Resource

The Department of Fish and Game deals with the management of all wildlife resources within the state and coastal marine areas. Wildlife refers to all species of animals which are not domesticated, including aquatic animals, both fresh water and marine. Traditionally, wildlife has referred almost exclusively to game animals but there has been more emphasis recently on the ecological and aesthetic importance of nongame wildlife.

Wildlife is only one component of a complex interacting web of plants and animals. The interrelationships between organisms and their environments form the framework of ecosystems through which forms of life are sustained and the environment is continually renewed. The type of ecosystem which each wildlife species requires to survive is referred to as its habitat.

Most forms of wildlife require a specific type of habitat in order to survive. Because of the close linkage between species and their habitats, a major responsibility of this department is to identify these habitats and work to preserve areas for the species to survive in adequate numbers. Fish and wildlife serve several purposes. Many species provide recreation for anglers and hunters. Others are nongame fish and animals, and in addition to serving a function within their habitat, they contribute to the general gene pool.

Long-Term Planning Needs

Spawning and nursery areas for salmon and steelhead need to be cleared and spawning populations need to be increased.

Species of fish which migrate to the ocean to mature but must return to their fresh water origins to spawn are known as anadromous fish. Usually the

spawning grounds are in streams and rivers, many of which are scores of miles upstream in the foothills and mountains. Among the anadromous species are salmon and migratory rainbow trout known as steelhead.

King (Chinook) salmon and silver (Coho) salmon are the only salmon that enter California rivers in significant numbers to spawn. Since the turn of the cnetury, salmon and steelhead populations have declined approximately 60 percent. Salmon, which annually support a $57 million recreational and commercial industry, produced a catch of 885,000 fish in 1978. The steelhead sport catch approached 122,000.

The Klamath River system, largest of the coastal California rivers, currently supports approximately 66 percent of the king salmon and 15 percent of the silver salmon that spawn in California's coastal rivers. The 3600 square mile Eel River system is the second largest coastal river spawning area. However, the numbers of salmon passing the Benbow Dam Fishway on the Eel River in Humboldt County have declined dramatically since counting was begun. The most recent counts indicate that the king salmon runs are relatively stable but the silver salmon runs are continuing to decline.

The Sacramento/San Joaquin Valley river systems support the remainder of the salmon and steelhead resource in the state. King salmon are the only salmon of any importance in this system. There are four major runs each year—fall, late fall, winter, and spring.

Several problems related to the damming of California rivers have adversely affected the salmon population. For example, gravel deposits which are essential to the protection of eggs and young fish have been lost through sedimentation and erosion. Replacement gravel that normally is transported downstream from upriver areas is now held behind the dams. Heavy metal contamination from mining operations and changes in stream flow patterns are other factors related to dams. Predators and water diversions, limited nursery areas, and other hazards, also affect the survival rate of young fish between hatching and reaching the ocean. In addition. large numbers of salmon are caught from the ocean by commercial and sport fishermen.

The present status of wetlands and modified wetlands needs to be stabilized and additional wetlands need to be acquired or preserved through incentives to private owners.

213

Of the approximately five million acres of wetlands which existed prior to European settlements, 91 percent have been lost. Coastal marshes have fared slightly better than inland marshes with about a 75 percent loss. Up to 94 percent of the freshwater wetlands of the Central Valley have been destroyed. Most wetland losses result from reclamation and water development projects related to agriculture, urban sprawl, and road construction.

Wetlands include a broad array of areas where land, water, and vegetation interact. They are generally inundated by enough surface or ground water to support vegetative or aquatic life that require saturated conditions for growth and reproduction. Some wetlands, such as vernal pools, can be saturated during the winter and dry out during the summer.

Wetlands are known for their value as habitats for wildlife. At least 50 fur and game species in the United States, exclusive of waterfowl, inhabit wetlands to obtain food, water, or protective cover. Wetlands are also essential to many aquatic species, both fresh water and marine, as breeding grounds and as nursery areas for the young until they are large enough to move into deeper waters.

However, the essential value of wetlands is their contribution to the natural food cycle and their great biological productivity which is sometimes said to be nearly ten times that of terrestrial land on a per acre basis. In these settings, dead plant matter and dissolved nutrients such as phosphates, nitrates, and ammonia act as the basic building blocks of the ecological food chain. Rich plant and invertebrate life flourish and they, in turn, support the fish populations as well as the feeding needs of birds and sometimes mammals.

Wetlands also serve a function of filtering pollutants and renewing water supplies, although this benefit can be lessened by overloads. Marshes, estuaries, and other types of wetlands are capable of removing inorganic nutrients, such as sewage phosphates and nitrates, and recycling them into the food chain, an expensive process when carried out in artificial systems created by humans.

Wetlands also filter stream flow sediments which settle in the bottom of the wetland and eventually bring about its demise through infilling. If natural processes are not interrupted by man's activities, in time every marsh becomes a wet meadow or upland, although the process, as it proceeds

214

naturally, can take thousands of years. As the watersheds around wetlands are stripped through timbering, development, and other activities, the delicate water-soil-vegetative balance can soon be overcome. The sedimentation rate is accelerated, water circulation is reduced, and stagnation and eutrophication tend to kill off the natural inhabitants and create breeding grounds for mosquitoes.

The Central Valley wetlands are particularly important as a stopping point and terminus for the Pacific Flyway which covers the western portion of the North American continent and portions of the Artic and eastern Asia. Most waterfowl using this flyway are hatched in the praries of western Canada and the river valleys and deltas of Alaska. Most of these birds winter from Washington to Mexico for about 60 percent of the flyway's total population. Approximately 10 to 12 million ducks and geese, accompanied by hundreds of thousands of shorebirds and other water-related birds, annually winter or pass through the Central Valley.

Key habitats need to be acquired, restored, and maintained for more than 900 species of fish and wildlife in California, including 212 presently identified species of rare, endangered, or threatened plants and animals.

Our understanding of the environment and the complex web of relationships that are essential to its successful functioning is still largely a mystery. The delicate balances which are characteristic of a single ecosystem fan out in every direction into the creation of increasingly complex balances with other living and nonliving organisms that are parts of other ecosystems until the entire planet can be seen as one ecosystem. The central and profound question faced by every expert in resource management is to discover where to enter into the solution of an environmental problem. This is the question faced by fish and wildlife managers in determining the choice of habitats that will generally enhance the welfare of our entire wildlife populations and, at the same time, enhance the quality of life for the inhabitants of our state, nation, and world. For this reason, probably the best approach to understanding the needs for habitats that can accommodate and nurture as many species of wildlife as possible is to describe the research and the types of knowledge about our environment, its inhabitants, and mutually shared habitats that we will have to develop within the near future. Listed below are a number of research topics that need to be studied along with the ongoing acquisition, restoration, and maintenance of habitats.

- Learn how judicious management can be applied to achieve harmony between the needs of wildlife and other uses, such as road construction, timber harvesting, and land use for recreation.
- Determine the ideal habitat conditions for various species of wildlife in different locations and at different points in their life cycles.
- Determine instream flow needs of fish populations on a stream-by-stream basis.
- Develop a marine nearshore habitat-type inventory, cataloging the habitat types in the nearshore marine ecosystems so that changes in the ecosystem can be evaluated and specific effects determined.
- Learn how the habitat requirements for wildlife species may conflict with other uses, such as the use of forest forage by domestic animals as well as wildlife.
- Identify the effects of bird populations on controlling insects which damage valuable timber species.
- Appraise damages to forest vegetation caused by wildlife species and determine acceptable control methodology.
- Study the effects of timber harvesting on livestock grazing on food and cover for different species of wildlife.
- Identify the characteristics of prime-fish habitats and determine the effects of land and water management.

Department of Forestry
1416 Ninth Street
Sacramento, CA 95814

The Resource

The Department of Forestry, located within the Resources Agency, and operating under the policies of the State Board of Forestry and Public Resources Code, is responsible for providing fire protection and watershed management services for the protection of private lands and state-owned lands in California, outside of the incorporated cities.

California includes a total land area of 100,191,000 acres. It is the third largest state in the country in terms of land area. About 33 percent or 32,558,000 acres are classified as forest areas. However, only about 16 percent of the total land area of the state is considered as commercial forest lands. These are forest lands that are suitable for growing and harvesting timber in a continuous cycle. The total resources managed by this agency include about 33 million acres of timber lands, range lands, and wildlife and fish habitats. Any public area with about 10 percent of forest cover is considered to be forested whether it is used for recreation, range grazing, or other purposes.

There are two major forest regions in the state. One is an intermittent strip stretching 450 miles along the coast from Monterey to the Oregon border with a maximum width of 40 miles in some places. This is the habitat of the California redwood along with other important commercial tree species such as the Douglas fir and white fir. The world's tallest tree, a 367-foot coast redwood, is located in this area in the Redwood National Park. The second major forest area is a pine region that extends the full length of the Sierra Nevada and along the inner mountain ranges from Oregon southward to just north of San Francisco Bay. The principal species in this region are ponderosa, jeffrey, white fir, red fir, and some hardwood species.

California ranks second in lumber production in the country; 35 to 40 percent of the timber harvested comes from the national forests. The balance comes from privately owned tree farms. Californians also consume more products based on wood processing than any other state in the nation. These products include labels, printing papers, newsprint, packages, furniture, and charcoal briquettes. As our technology increases, the processing of wood-based chemicals is becoming a new and important industry with widespread applicability. One example of a wood-based chemical is torula yeast, a high protein product made from wood sugars spent in the pulping process. One variety, Type S, is used in baby foods, cereals, baked goods, and beverages. Type F is used in feed supplements for commercial domestic animals. Still another variety, Type FP, is used in pet foods. Other wood products, such as ethyl cellulose and similar chemical-based celluloses, are used in making a variety of products including football helmets, photographic films, medicines, fertilizers, and cosmetics.

Forests also provide us with another resource that we are just beginning to recognize. That is clean air. Through transpiration, the forest gives up moisture and oxygen to renew the earth's atmosphere. The present climate of the earth is partially determined by the size and location of forest lands on the planet. The effects of forestation on climate are immediately noticeable in urban areas where natural growth serves a variety of functions.

The forests also provide the habitats which are indispensable to the maintenance of living organisms of all types. Many species of birds and other wildlife animals depend on various stages of forest succession for their habitats. Even the anadromous fish such as salmon and steelhead that spawn in California rivers depend on a forested watershed for the water supply that makes possible their annual journeys up the streams and rivers. Domestic animals that graze on the rangelands under management by this agency are a source of food and other materials which are important for the maintenance of our lifestyles.

Long-Term Planning Needs

Growth and harvest of timberlands needs to be managed to assure a consistent yield and continuing renewal of forest resources.

Timber production in California has steadily declined for the past two decades. This is due partially to the withdrawal of commercial timberlands for other uses such as parks and wildernesses, as well as commercial development. The Forest Service classified 7.6 million acres of privately owned land in the state as commercial forest land. Information available about the condition of these lands is spotty and the annual yields vary widely.

The most dependable source for timber production is approximately 2.7 million acres of commercial forest land owned by companies with forest product mills. An additional 1.5 million acres are owned by companies that regularly supply the mills. These companies manage their lands on a continuous yield basis. The total acreage in these ownerships is increasing and the number and size of these holdings has been changing generally toward fewer and larger companies.

At present about 35 percent of the harvested timber comes from the national forests and the remainder comes from privately owned tree farms. Continued conversion of private commercial forest land to nonforest use if

decreasing the productive capacity of the state to provide the needed timber. However, under recent legislation, counties can designate land as Timberland Preserve Zones (TPZ) which can be used only for production of forest products. Tax allowances are also granted which make the investment profitable. By 1978, 75 percent of the private commercial forest land was in TPZs.

The old growth inventories are continuously being reduced and replaced by young growth through commerical harvesting and reforestation. Replanting is making the California forests more ecologically diverse than ever before. However, the overall quality of timber is reduced as the young growth increases and the old growth decreases. Parks, wilderness areas, and other preserves are becoming the last refuge for old growth.

Reforestation of 1.4 million acres of timberland, mainly in private ownership, is an important need for the immediate restoration of the productive capacity of the commercial timberlands. State cost-sharing plans are in operation to encourage the reforestation of privately held lands. Vegetation management programs also are being implemented in young timber stands to increase forage production, water yields, wildlife habitat, survival of seedlings, and growth rates. Through vegetation management, damages from fires and soil erosion are expected to be diminished or averted.

Massive urban reforestation is needed to improve the quality of life in these areas.

When the 1978 legislature passed the Governor's Urban Forestry Program, it began a new era for the California Department of Forestry. Ninety-four percent of the population of California lives on two and one-half percent of the land. Many of these areas are currently losing trees faster than they are replaced through insects, diseases, old age, vandalism, and urban development.

Forestation in urban areas offers many advantages for improving the physical and visual impact of the environment. For example, carefully placed trees can shield a building from the sun's direct rays during the summer more than during the winter. Shrubs can also shield walls from direct heat of the sun. Vegetation cools the environment during hot weather by reflecting much of the sun's rays, unlike concrete that absorbs the heat all day and radiates it at night to raise the ground temperature.

Trees also create breezes by attracting warm group air up as coolness is created by transpiration through leaves. Equally important is the aesthetic impact trees, shrubs, and other plantings have on the appearance of our environment and our mental well-being. They also provide an urban habitat for animals such as song birds and, in some areas, ground animals such as squirrels. Urban forestation also reduces noise pollution.

Several aspects of urban forestry are currently under study as part of a nationwide project sponsored through the Federal Forestry Service. One task is to select trees and other plantings that require minimal supplies for the semi-arid urban environments that characterize California. In some areas, deciduous trees that lose their foilage during the winter are most desirable for use in energy conservation. During the summer, they provide shade protection from the heating effects of the sun's rays. However, during the winter the sun's less powerful rays can permeate the bare limbs and provide heat. Another thrust is to develop resources and values that will cause people to participate in urban reforestation programs. Already, in many parts of the state, groups are working to recruit volunteers for major replanting projects.

Urban reforestation, to be sustained over years, will depend on cheap and readily available supplies of seedlings and young trees for replanting. This will require the establishment of urban greenhouses and other urban sources for the acquisition of all types of planting. Because of the newness of the program, these facilities are still in the planning stages with consideration for such factors as optimal locations for creating urban employment and the variety of plants and trees that would be most desirable for a particular urban location.

Forest fires are a major threat to the depletion of our forest resources, the loss of wildlife, and the destruction of built environments.

California leads the nation in its unique wildland fire problems. The historic approach of adding more expensive and sophisticated fire suppression forces can no longer be maintained. It is not only too costly but the end effects of relying on this approach exclusively are less productive than other methods.

One approach that holds promise for reducing the threats of fires is to reduce the fuel loading of old growth within the forest and on chaparral lands. This requires regular and controlled burning off of the undergrowth

in the forest and on the open chaparral lands. By purposely burning off the shrub undergrowth before it becomes too thick, fire temperatures can be kept within the range that will not be damaging to the established tree growths. However, by allowing the undergrowth to build, when fires are started, the heat becomes intense enough to destroy all plant life including the trees. Burning off the chaparral areas, allows for the gorwth of grasses and other plants less dangerous in terms of being fire hazards. Interestingly, it has been established that wildlife populations prefer forested areas in which the undergrowth is kept down. Thickly forested areas with excessive amounts of underbrush are generally avoided by wildlife populations. Hence, this resource management technique also benefits preservation and growth of wildlife in the forested areas.

Research needs to be conducted and methods developed for the use of residues from timbering and waste materials from forest clearance as an energy source.

There is a long list of benefits that could occur from the systematic harvesting of wood residues for energy production. For example, wood is a renewable, biodegradable, and naturally stored fuel. Clearing forests of the undergrowth that creates devasting forest fires not only ameliorates that problem, but also decreases the need for hazard reduction burning. Clearing forests of logging residues for the production of energy is an added stimulus for improved silva-cultural practices which can offset some forest improvement costs.

Wood conversion technologies are relatively simple and potentially more reliable than technologies using coal and oil. This source of energy can be refined and packaged in rural areas, providing employment and self-sufficiency for these areas. It is also a potential source of income to landowners who can clear their own lands and sell the waste materials to a local wood conversion operation.

Several avenues for the eventual use of this resource are currently being explored. For example, one project explores the use of hardwood-encroached lands. The hardwood timber is used for energy production as the lands are replanted with softwoods, more useful in commercial timber production. Other studies are being conducted on the economic feasibilities of using wood as an energy source. One project conducted jointly by the California Energy Commission and the Department of Forestry is demonstrating the technical and economic feasibility of using a gasifier/engine generator system to supply electrical requirements for a conservation camp operated by the Department of Forestry. Eventually, a step-by-step procedure for establishing similar systems throughout the country will be produced.

Studies are also being conducted on the effects of the clearing of logging residue and underbrush on the nutrient cycles in different areas. At present, these studies show no adverse effects. Urban parks, such as the Golden Gate Park in San Francisco, generate large volumes of wood residues from maintenance and replacement activities. The Golden Gate staff, in collaboration with the Department of Forestry, has developed a program to use the residues, providing an alternative to conventional heating fuel sources and mitigating the problems of residue disposal.

Department of Parks and Recreation
1416 Ninth Street
Sacramento, CA 95814

The Resource

About six million acres of California's mountains, deserts, and coast are managed for park and recreation purposes by various federal, state, and local agencies. The California Department of Parks and Recreation, as part of its overall responsibility for statewide planning and policy in the park and recreation field, manages about one million of these acres within the California State Park System. This includes some 250 state parks, beaches, wildernesses, natural preserves, historic sites, and recreational areas throughout California.

The State Park System accommodates more than 60 million days of visitor use each year in camping, picnicking, fishing, boating, sightseeing, and a hundred other activities, including many kinds of environmental learning experiences.

Everyone thinks of parks as places for recreation where you can hike, swim, picnic, or play baseball. One of their important purposes is to provide a

release from physical tensions, a health-building experience. They also serve as a unique setting for understanding our history and our cultural heritage. But most importantly, they are places where men and women may come to discover, understand, and appreciate the interrelationships and interdependencies between people and their environment. They are a means of making us aware of the world around us. They provide a chance to see that world as it is naturally, not as modified by other human beings. They expand our sense of values beyond the merely economic. They provide an opportunity for contemplation, reverie, solitude, and peace. They are "islands of hope."

Long-Term Planning Needs

Increasing public demand needs to be met, while sustaining the high quality park experience.

Park use continues to increase at an even faster rate than the state's population. Thousands are turned away at popular parks and recreation areas during peak vacation periods. Existing facilities are strained, sometimes even to the detriment of the resource itself as when deeply rutted trails erode a meadow, or constant use of a campground compacts the soil and suffocates redwood roots.

Lands that are suitable and available for park use are not unlimited, and competition for land of any kind is becoming increasingly intense. Costs for both acquisition and development continue to rise. Funding to operate and maintain existing facilities becomes more difficult to obtain. Comprehensive long-range planning is essential to meet human needs while preserving the environmental quality on which all else depends.

More urban parks need to be developed and many that exist need to be upgraded.

Ninety-four percent of California's citizens live in urban and suburban areas on two percent of the land. Urban parks and recreation areas are essential in many ways to the preservation of our health as a society. Often, they provide the only open space for relaxation and recreation in congested areas. Urban parks with natural growth such as trees and bushes reduce pollution, reduce noise, alleviate temperature extremes, reduce energy consumption, provide soil and watershed protection, improve urban wildlife habitat, and beautify neighborhoods. They also often serve as the only continuing contact which people have with the natural environment, and provide an aesthetic quality that exists nowhere else in an urban area. The importance of urban parks is now being recognized, and they can be expected to receive increasing attention in the years ahead.

Parks and their programs need to serve a broader population, particularly minorities, the disabled, and the elderly.

Many of those who most need the benefits parks can provide are unable or disinclined to use them. A major effort in park systems at all levels is to make park and recreation facilities more accessible to the disabled, to develop programs that will more effectively serve minorities, the elderly, and other populations with special needs.

There is a need for greater public involvement in planning parks and in operating them.

Public involvement is being increasingly recognized as the foundation for good planning. People need to participate in all stages of the planning process so it can be responsive to their needs. And they are needed more than ever when the plans come to fruition; many park programs would not exist without the help of dedicated volunteers. Parks need people as much as people need parks.

New strategies must be found to help parks become more self-sufficient economically.

Park values should not be measured solely in terms of economics, but neither can economics be ignored. Parks must compete for public dollars, and the more nearly they can become self-supporting, or find ways to offset some of their costs, the better they may be able to afford some of the things that do give parks their highest value.

There needs to be a new look at how people get to parks.

In spite of people's reluctance to abandon their cars, transportation patterns may be changing. It's becoming less and less feasible to travel halfway across the country to go through 20 parks in as many days. The cost-conscious are staying closer to home and remaining longer in one place. Interest in public transportation is reviving. Park planners, hopeful that the

day of giant parking lots is passing, feel whole new concepts may be necessary.

How to use parks in environmental education

You don't have to go to Pt. Lobos to learn about the natural environment. A patch of weeds at an asphalt playground will illustrate most environmental principles. But, because these great places are outstanding, they command attention. A trip to the redwoods or the desert makes a lasting impression that no child can forget. A wilderness experience can only be had in a wilderness.

Learning about how people lived in an historic period can give perspective on how we live today, on the choices we make about how we use our environment. And there is a profound difference between actually going to a place and just reading about it. That's not to say you should overlook the park next door, either. It, too, can offer a variety of habitats, of plants and animals—and, all too often, a drastic contrast with its surroundings—that can be used in a lot of teaching ways.

The California Department of Parks and Recreation has environmental living programs at several of its units, where classes can stay overnight and "re-live" the life of an historic period. But these programs can only handle a relatively small number of classes and are usually booked far in advance. Some parks have shorter, daytime programs of a similar nature. Efforts are being made to mesh the park system's offerings with this new statewide environmental education curriculum, and most parks have at least some informational materials on the resources they have available. At the very least, there is almost always a ranger with whom you can discuss your needs.

225

Department of Water Resources
1416 Ninth Street
Sacramento, CA 95814

The Resource

The Department of Water Resources provides leadership for the management of California's water resources. The Department's programs are designed to implement a California constitutional requirement that the state's water be put to the fullest possible beneficial use, and that waste and unreasonable use of water be prevented.

Water, seemingly, is everywhere. It covers three-fourths of the world's surface as a liquid. It is also present in the atmosphere in a gaseous state and large amounts exist in a solid state as the polar ice caps. The water in the oceans and the ice at the polar caps comprise 99.3 percent of the water on the planet. The remaining 0.7 percent, at any one time, exists in the atmosphere, lakes, rivers, soil, and subsurface deposits. Water is the primary constituent of all animal and vegetable matter and the processes of life depend on a constant interchange of water between living matter and the environment.

California has 12 hydrologic basins into which water from precipitation flows. The total annual supply of water in California is estimated to be 31.3 million acre feet, although average annual precipitation amounts to about 200 million acre feet. (An acre foot equals approximately 326,000 gallons.) The difference between precipitation and availability is lost for human use through evaporation from the surface of vegetation, ground, and water, through transpiration from vegetation, and through runoff to the oceans.

The runoff from precipitation in these twelve basins is one major source of the water we use. Most of the state's runoff occurs in the north coast and the

226

Sacramento basins. This is also where the two major forest areas in the state are located, one running down the coast from Oregon and the other following the mountain ranges to the east of the valley from Oregon to the San Francisco Bay Area. In terms of both water supply and water quality, the condition of the flora in the upper regions of a runoff basin is critical. The high, steep portions of the basin usually receive the largest proportion of the rainfall and the vegetation on these slopes, if it is thick, prevents the erosion of soil, allows the runoff, and enhances absorption of the water into the soil, ensuring a well-regulated runoff flow and good quality water.

The second major source of water supplies is the underground deposits called aquifers. These are natural reservoirs which water seeps into and is stored. Aquifers develop very slowly over long periods of time that can range to thousands of years.

A quick survey of the figures for average annual runoff in each of the basins reveals that there is an uneven distribution of rainfall and the need for water in California. The largest population centers are in the south were the least amount of rainfall occurs and the water reserves are the smallest. Similarly, the San Joaquin and Tulare Lake basins are the sites of a large percentage of the most productive farmlands in the state. Water management practices, traditionally, have developed storage and transport systems—dams, reservoirs, canals, and aqueducts—that can ensure a constant supply of water from the high rainfall areas to where it is needed.

Human needs for drinking water are far less than needs for washing, flushing toilets, and other ways in which water is consumed in daily living. Industrial needs consume considerably more water in manufacturing processes and in generating power than humans do in daily living. Agriculture, however, is the single most water-consuming activity in the world. In California, agriculture uses 85 percent of the total amount of water consumed in the state. Most of this is lost through transpiration as crops mature and through evaporation as the land is irrigated. Following are estimates of some water requirements:

USE	AMOUNTS REQUIRED	
	Liters	Gallons
Drinking water (adult daily)	1	0.26
Toilet (one flush)	20	5.28
Clothes washer (one load)	170	44.88
Refine a ton of petroleum	2,000 - 50,000	528 - 13,200
Produce a ton of steel	6,000 - 270,000	1,584 - 71,280
Grow a ton of wheat	300,000 - 500,000	79,200 - 132,000
Grow a ton of rice	1,500,000 - 2,000,000	396,000 - 528,000
Produce a ton of milk	10,000,000	264,000
Produce a ton of beef	20,000,000 - 50,000,000	528,000 - 1,320,000

227

228

Long-Term Planning Needs

Present overdrafting of groundwater supplies is threatening the availability of a continuously dependable supply of water in the future.

Groundwater is stored in aquifers which are natural underground reservoirs in porous rock below the soil surface. The location of aquifers is dependent on the permeability of the soil and rock layers in an area. Groundwater, obtained through drilling wells, is the cheapest and most accessible alternative to surface water supplies. When groundwater is withdrawn at a rate greater than the recharge rate, the water table drops, increasing the depth to which wells must be drilled. Since drilling costs increase rapidly with depth, withdrawing the groundwater can become uneconomical. In these cases, aquifers can be thought of as a nonrenewable resource that has been mined out. Often, not only the groundwater resource is lost. Surface streamflows can be severly reduced with the lowering of the water table and ecologically important wetlands can dry up. In coastal areas, depletion of freshwater aquifers can lead to the intrusion of saltwater, and, again, permanent loss of the resource.

Groundwater supplies have been permanently depleted in parts of Arizona and in the high plains of Texas where water tables have fallen up to 30 meters. The principle overdraft area in California is the San Joaquin Valley where the safe yield of groundwater is exceeded by 1.7 million acre feet each year. Without other supplies of water, a region can suffer a serious decline economically and in other related ways. Moreover, the decline in groundwater supplies also threatens the maintenance of a dependable supply of water in dry years and can also cause economic decline because of periodic droughts. In some areas, development moratoriums have already been declared because of serious declines in the water table.

There are two basic approaches to dealing with the problem of overdrafting groundwater. One approach is to develop a comprehensive statutory system of groundwater law. This requires the establishment of groundwater management areas based on the survey of geological conditions and the identification of major groundwater basins.

The other approach is to recharge the aquifers during wet years using technology that will allow for quick absorption of the water by the porous rock. Aquifers, in one way, are very preferable to surface reservoirs because

of the evaporation problem which can be particularly severe in hot, dry areas. For example, losses through evaporation at Lake Mead have been measured at one cubic kilometer per year or about 4,500 liters (1,190 gallons) for each person in the United States.

Waterlogging and salt accumulation on irrigated lands is threatening agriculture production.

Waterlogging, salinization, and alkalinization commonly occur when irrigation systems, particularly in arid lands, don't allow for proper drainage. As the water flows through the soil, salts and other solid deposits are filtered out and these accumulate. The San Joaquin Valley is the region most seriously affected by this problem. About 400,000 acres at present have high brackish water tables that pose a threat to the productivity of the land. When the water table reaches the root zone productivity is sharply curtailed. It is estimated that 700,000 to one million acres will seriously be affected by this problem by the year 2000. Lost crop production could reach $320 million annually by the year 2000. One approach to this problem is to install subsurface drainage systems for individual fields and a master drain for a large area. This can be very expensive both initially and in the maintenance of the system to assure continued adequate drainage.

A more economical approach is to grow more salt tolerant crops such as barley, cotton, and sugar beets. Studies are being conducted to test the effects of brackish water on these types of crops.

A third approach is to build desalting plants. So far, however, the desalting process has been very expensive. In 1975 there were about 700 desalting plants in the world but almost none were used in agriculture. Larger plants averaged a cost of around 15 cents per cubic meter and smaller ones ranged from 25 to 50 cents. This price excludes use for all but very high-value crops such as tomatoes, avocados, and orchards. Experimental plants are in the design stages using biomass conversion, solar pond power generation, and recovery turbines in conjunction with ponds and marshes in an attempt to reduce the cost of the desalted water.

Widespread water conservation practices can reduce the need for developing new water supplies in the future to meet the needs of an increasing population and industrial growth.

The most economical and environmentally safe way of increasing the real

supplies of water is to conserve through reduced consumption, using the existing supplies more efficiently. However, probably because of the widespread presence of water and its importance for our existence, it has not often been thought of as have other natural resources such as petroleum, minerals, and coal. As a consequence, the methods for water management and use have been quite different from those methods used for the other natural resources. For example, water has historically been very cheap regardless of the supply, and even in areas or times of shortage it has been put to low-value uses such as watering lawns or filling swimming pools with no regard for the consequences to higher-value uses. Water consumption has been accepted almost as a personal right. Instead of placing limitations on its use and practicing conservation, emphasis has been placed on transferring supplies from one water basin to another which sometimes has had disasterous environmental consequences.

In fact, a substantial part of municipal water use in the United States is the result of leaks, including running toilets, and dripping faucets as well as letting a tap run unnecessarily. Retrofit devices have been used effectively to reduce consumption. For example, 35 major urban areas throughout the state showed a 21 percent reduction in water use in 1977 compared to 1976. Water conservation has persisted to the present time and is still 17 percent less than in 1976.

Industrial uses also account for much of the wasted water. A good proportion of quantities required by industrial processes can be recirculated instead of being permanently withdrawn from existing reserves.

Irrigation, the prime consumer of water in California, can be managed more efficiently from the standpoint of water consumption. For example, high frequency irrigation, using smaller amounts at more frequent intervals and through pipes, has the potential for saving considerable amounts of water. The use of computers in this operation has the potential for further increasing conservation effectiveness. As mentioned above, planting crops that are more tolerant of the salt content of water is another way in which agriculture can increase its efficient use of water.

Probably the most effective means for conserving in the consumption of water will be found in adjusting prices to reflect the scarcity of this resource in a particular region. Heretofore, society has subsidized people living in arid regions by making the cost of water artifically low. Through

pricing practices that reflect the actual scarcity of the commodity and adjustments to prevent the demise of industries such as agriculture, it is hoped that water management practices will be brought more in line with the economic laws that govern scarcities of the other natural resources.

Water distribution systems need to be further developed to meet the expected needs for water by the year 2000.

Projections place the demand for dependable supplies of water in California at 4 million acre feet annually by the year 2000. With effective conservation programs, this figure can be reduced to 3.4 million acre feet per year. As noted above, the major areas for water supply are in the north and the areas of greatest need are in the San Joaquin Valley and the coastal areas in the south. The source with the greatest potential for supplying water is the Delta region in the Central Valley. It is here that the flows from the Sierra Nevada, cascading down the western slopes in a myriad of streams, converge in the Central Valley to form the greatest river system within the boundaries of a single state in our country.

Some of the problems related to using this area as a major source of supply for other parts of the state are political and some are environmental. Often, in the past, water has had a peculiar local nature that is not attached to other natural resources. Some areas can enjoy an abundance while adjacent areas suffer from a scarcity. People and industries upstream can pollute water through a variety of ways such as the runoff from fertilizing practices without regard for the consequences to people's needs further downstream. In other cases, upstream areas can siphon off most of the water supplies for activities such as irrigation and leave inadequate amounts for those areas closer to the mouth of the river or stream.

The use of water from the Colorado River is a case that illustrates both of these points. Originally, Mexico was not included in the water sharing agreement and, as a result, very little flow was left by the time the Colorado River reached that area. Salinization from irrigation later became a problem when it reached such high proportions that the water, once it crossed the Mexican border, was virtually useless. Fortunately, both of these problems have been settled in an amicable way.

The political power manifested in the sheer numbers of people in the southern coastal region has been perceived, in some instances, as the only

reason why water diversification projects are being planned. Extreme sentiments against these plans in the northern areas have led to abortive threats to take actions such as seceding from the state.

There is also the fact that plans to divert large amounts of water from the Delta to the southern areas will produce negative environmental effects in the north such as the influx of saltwater through the San Francisco Bay and the Carquinez Straits. Others say that controlled releases of water to the Delta would protect the San Francisco Bay-Delta Estuary and the Suisun marsh while also providing good quality water for transport to the southern part of the state.

The controversy surrounding the movement of great amounts of water from one basin to another is being experienced in other parts of the world such as in the controversy that erupted between India and Bangladesh when the former drained much of the water out of the Ganges River to flush out the Calcutta Harbor and seriously depleted the supplies needed for irrigation by its neighbors.

All of these problems are, in turn, an indication that people and nations all over the earth are becoming more aware of water as a limited natural resource. As demands on the available water increase, this resource is being viewed more as other natural resources are and is being subjected to the same economic laws that regulate their use.

State Lands Commission
1807 - 13th Street
Sacramento, CA 95814

The Resource

The State Lands Commission acts as the manager for about 4.5 million acres of land held in trust for the people of California. One portion of these holdings, about 4 million acres, was acquired as sovereign lands when California joined the Union in 1850. Approximately the size of Connecticut and Delaware combined, these lands include the beds underlying about 30 navigable rivers throughout the state such as the Klamath and Sacramento, the basins of almost 30 navigable lakes such as Lake Tahoe and Clear Lake, and the three-mile-wide strip of tide and submerged land adjacent to the coast and offshore islands.

The other portion of these lands, about 610,000 acres, is the remainder of a federal grant made to California shortly after statehood to support public education. In that grant, the state was given two square miles out of each 36 square miles held by the federal government. Originally, that amounted to about five million acres, most of which was quickly sold to private holders. The remaining portion, no longer subject to sale, is currently being consolidated through exchanges with other public land holders into larger blocks that are more economically useful.

The Commission is composed of two elected public officials, the State Controller and the Lieutenant Governor, and one cabinet level officer appointed by the Governor. This composition was determined in 1938 when the Commission was formed to assure that public interest in the use of these vast holdings would be safeguarded. Revenues from the original school lands are still used for support of the public school system.

Long-Term Planning Needs

Energy and resource development on the lands managed by the Commission needs to be promoted and guided by the procedures that will provide the most benefit for the citizens of California.

Oil and gas deposits on state lands, particularly in the tidelands and submerged offshore areas, are an important resource that is being developed through the collaboration of the public and private sectors. Average daily production of oil on state lands is approximately 100,000 barrels. Revenues for 1981-82 are estimated to be enough to enable the Commission to produce more revenue than any other nontax state agency. The Commission has successfully formulated firm procedures to avoid oil pollution accidents caused by wells on state-owned lands as evidenced by the fact that not one major incident has involved wells located on lands leased by the state. One reason for this successful record is that potential environmental impacts are rigorously assessed before any drilling operations are allowed.

The largest geothermal electric generating complex in the United States is located in Sonoma County at The Geysers. More than half of the steam used to generate electricity at this site comes from state geothermal leases. Over a half million acres of state-owned land are located in regions with geothermal potential although only a small portion of that area has been explored. The Commission's task is to promote full use of these resources

while safeguarding environmental quality and maximizing economic benefits to the public.

Other resource development activities include timber harvesting and grazing leases on the remaining school lands. Additionally, although the state sold large portions of the original school lands grant, mineral rights were retained on 716,000 acres. Consequently, now the Commission leases some of its rights for mining operations and collects royalties for the production of sand, gravel, precious metals, iron, and other minerals.

General development of lands managed by the Commission needs to be promoted in a manner that safeguards public use of all navigable waters within the state.

Almost since California became a state, the legislature has granted tide and submerged lands in trust to cities and counties so that these regions could develop harbors and waterfronts in accordance with locally developed plans. In many places, these granted lands have been developed into marinas, harbors, aquatic parks, and other types of recreational areas. Although these lands are under local control, the Commission has responsibility for monitoring the sites to ensure compliance with the terms of the statutory grants. These grants, traditionally, have been designed to encourage the maximum development of tidelands in a manner that is consistent with the public's best interest while requiring the grantees to reinvest any revenues produced back into the lands where they are generated.

The Commission also has authority to issue permits for the dredging of harbors and waterways that have become obstructed with mud or silt. These permits are granted to both public and private parties. Other dredging initiated by the Commission is done to improve the configuration of the shoreline and to reclaim private and public lands.

The Commission also has responsibility for two public service projects. One project resulted from the 1977-78 drought. When waters receded as a consequence of the drought, a large number of hazardous objects such as pilings, discarded junk, and other large objects were discovered within the navigable waters in many areas. The Commission has been given responsibility for a massive undertaking to identify these hazards and remove them. Current efforts are being concentrated in the areas of Lake Tahoe and the Sacramento/San Joaquin Delta. These efforts also include the removal of abandoned oil drilling equipment in the tidelands and submerged areas.

The second project, to clarify water boundaries, is the result of more intensive use of waterfront lands. Because land was abundant and put to low density use until recently, many early land descriptions which involved water boundaries were vague and uncertain. Within the last 50 years the determination of these boundaries has become a problem of increasing proportions. Now, it is estimated that more than 7,000 miles of common water boundaries between public and private lands are in dispute. The Commission has relied on historical records, maps, minutes of public meetings, archives, and interviews with historians and local longtime residents as some of the sources for resolving these disputes. The resolution of these land title problems is important not only to protect the public's resources, but also to enable private parties to obtain sufficient title insurance.

State Solid Waste Management Board
1020 Ninth Street, Suite 300
Sacramento, CA 95814

The Resource

In 1972 the California State Legislature established the State Solid Waste Management Board to develop and maintain a state program of nonhazardous waste management and resource recovery which would protect public health and safety, promote economic productivity and environmental quality, and conserve natural resources.

Californians generate about 46 million tons of nonhazardous waste each year and pay approximately $600 million annually to have it disposed of in various ways. Presently, most solid waste is landfilled. However, landfill sites are becoming less available, and it is anticipated that only three-fourths of the present capacity for disposing of solid waste in this way will exist by the end of 1990. Unless other options for the disposal of solid waste can be developed by that time, California will be faced with a serious garbage crisis.

The Legislature acted in 1977 through SB 650, the Litter Control, Recycling and Resource Recovery Act, to give the State Solid Waste Management

Board responsibility to develop public awareness of the crisis, foster a new ethic toward waste disposal, and develop new systems to recover materials and energy from garbage. The board's management activities include state and local planning, enforcement of environmentally sound landfill practices, recycling, resource reuse and energy recovery, litter control, waste reduction, and public education.

Long-Term Planning Needs

Fortunately, there are alternative systems to landfill disposal of solid waste. However, each of the options has advantages and disadvantages that need to be taken into consideration when developing a long-term plan for solid waste management. The following assessments describe alternative methods for dealing with the growing waste generated by our society.

METHOD: Waste Reduction

Waste can be prevented at its source by altering manufacturing processes, product and packaging design, patterns of consumption and waste generation to conserve natural resources and energy, and to extend product lifetime. Examples include purchasing products with minimal packaging, manufacturing more durable and fuel-efficient products, and reusing products rather than disposing of them.

	PRO	CON
ECONOMIC	Reduces municipal disposal costs. Reduces energy used in manufacture. More efficient use of natural resources. Can create new job opportunities.	Major capital investments for industry. Intrudes on free enterprise system. Loss of feedstock and revenues for resource recovery projects. Can create job dislocation.
ENVIRONMENTAL	Reduces litter and pollution. Preserves natural resources. Promotes efficient land use.	Sanitation problem from storage of reusable food containers.
TECHNOLOGICAL	Existing technology is used to create more durable products.	Additional research needed to create more recyclable products. Product design technology is insufficient.
IMPLEMENTABILITY	Can be done by all sectors. Requires minimal initial effort by consumers.	Resistance to change in behavior by citizens, government, and industry. Lack of external incentives discourages participation. Conflicting data impedes decision making. Inadequate public awareness.

CONCLUSION

Waste reduction is the initial and most important alternative to solid waste disposal. However, it is a highly complex and controversial issue because it is intertwined with philosophical considerations regarding the role of government; the functioning of the free market; the relative value of social, economic, and environmental factors; and concepts regarding the quality of life as measured by the consumption of material goods.

METHOD: Landfill

Landfills are now the final repository for most solid wastes. The wastes are unloaded, compacted so as to reduce the volume, and covered with soil.

	PRO	CON
ECONOMIC	Inexpensive alternative (approximately $3-5 per ton). In some cases, energy recovery from landfill-produced methane gas may be economical.	Landfill costs are expected to increase because of increased haul distances and compliance with environmental standards. Capital costs for land close to waste sources is increasing due to urban development.
ENVIRONMENTAL	Previously unusable land (e.g., gravel pits) have been reclaimed for some social use.	Use alternatives for usable land are limited. Poor operations may result in odors, propagation of disease vectors such as flies, groundwater pollution, and/or migration of explosive gases. Most landfills will be energy consumptive. Energy and material resources in the wastes are lost. Even with gas-recovery energy resources are not fully used.
TECHNOLOGICAL	No new technology is required for existing practices in landfill operation.	Environmental monitoring, control, and cleanup techniques for odors, gas migration, and groundwater pollution are not well developed.
IMPLEMENTABILITY	Landfills are needed for residuals of any alternative.	Poor landfill operations create adverse public impressions, creating barriers to obtaining land-use permits.

CONCLUSION

Landfill is perceived by the public to be less desirable than resource recovery and common belief is that landfills are obsolete, unneeded, unacceptable, and a waste of resources. Its economic advantages will rapidly diminish with increased haul costs. The requirements for new landfill will not disappear but will be diminished by implementation of resource recovery.

METHOD: Composting

Organic wastes (paper, leaves, food, etc.) can be converted into humus-like compost through aerobic (with air) bacterial decomposition.

	PRO	CON
ECONOMIC	Small scale composting is not capital intensive.	Large scale composting is capital intensive. The commercial compost market is very limited and is currently being served with compost made from other wastes (sewage, sludge, manures, wood bark, etc.).
ENVIRONMENTAL	Represents a closed loop ecological cycle whereby substances grown from the land are ultimately returned to the land for recycling. Improves soil and increases productivity of humus-deficient soils. Reduces landfill space requirements by 60-70 percent.	Composting is energy consumptive; requires approximately 1.5 gallons fossil fuel per ton of compost or 1,500 BTU/lb. to process. Heavy metal impact on crops from sludges are under study. Odor, nuisance, rainfall runoff, and leachate must be controlled. Requires controlled operations to insure destruction of pathogens present in sludge.
TECHNOLOGICAL	The composting technology is proven for conversion of organic material. Composting technology is not complex.	Removal of pieces of plastic and glass shards from waste is preferable to ensure quality of the finished compost.
IMPLEMENTABILITY	Vegetative composting appears easy to implement on a local basis for local consumption.	Acceptance by farmers of refuse-derived compost is problematical. Repeat compost markets are limited; market and usage are not constant.

CONCLUSION

Composting has the potential of reducing landfill space requirements, yields a beneficial soil amendment, and is easily implementable; however, impediments in developing composting as a practical alternative exist in the level of control required to produce a safe quality product, lack of constant markets, and resistance to use of composts produced from municipal refuse.

METHOD: Source Separation
Waste materials to be recovered (metal, glass, paper, etc.) are separated at the point of generation (household, office, etc.) for collection.

	PRO	CON
ECONOMIC	Little or no processing required to produce marketable material. Permits use of systems for handling low volumes of materials at each collection point with a very high yield at the central collection depot.	Increased labor and collection equipment is required if participation exceeds 20 percent. Profits are very vulnerable to market fluctuations and (except for paper) to container legislation. Major profit taking occurs at the central collection depot.
ENVIRONMENTAL	Increased education of the public, reduced consumption of virgin materials, and reduction of energy required through use of recycled materials. Can reduce landfill requirements for municipal refuse by an estimated 20 percent maximum assuming 100 percent participation and 100 percent retrieval efficiency.	Collection at many separate sites increases energy consumption. Data available indicate that the participation required to significantly reduce landfill requirements will be very difficult to achieve and sustain.
TECHNOLOGICAL	No new technology required for single family or commercial pickup.	Multi-family residential technique still developing.
IMPLEMENTABILITY	Has been implemented commercially for many years on specific items such as corrugated paper. Can be implemented immediately in some localities. Can be implemented with little capital investment.	Large scale implementation has not been achieved. Data on costs and market impacts are unreliable. Volumes and revenue are vulnerable to changes in participant behavior.

CONCLUSION
Source separation increases public awareness of the solid waste problem and has the potential to reduce projected increases in waste generation and requirements for processing facilities. This is the only system theoretically capable of achieving a 25 percent reduction in landfilled waste in the near future, but only by participation that has not been achieved anywhere on a large scale.

METHOD: Mechanical Separation and Production of Refuse-Derived Fuel

The municipal waste stream has a significant glass, metal, and energy content. These wastes can be mechanically separated into usable or salable products through combinations of devices called "front-end" systems. Waste materials that have been shredded and air classified can be used in conversion processes to create energy, chemicals, or compost. These conversion processes are called "back-end" systems. A densified RDF (dRDF) that is more easily transported and stored can be produced through pelletizing or chemical modification but at additional expense.

	PRO	CON
ECONOMIC	The system can be customized for specific markets. Magnetic ferrous separation is economical in some areas.	Substantial operating costs are involved. Produces more contaminated materials than source separation, hence affecting market value. Usually more expensive than direct haul to presently available landfill.
ENVIRONMENTAL	Permits conversion or reclamation of up to 80 percent of the municipal waste stream. Shredding of wastes reduces landfill acreage and cover requirements by up to about 30 percent.	Requires mitigation measures to control air, noise, or water pollution at processing facilities. Disposal requirements for residual materials not well known.
TECHNOLOGICAL	Mechanical facilities can handle the large quantities of waste generated. Shredding and magnetic separation are fully developed operations.	Shredders require extensive servicing. RDF, unless densified, is difficult to store and handle. Densified RDF (pellets, dried and powdered) adds significant cost and has not been adequately tested for economic benefits in a large scale operation.
IMPLEMENTABILITY	Facility can be developed in stages as markets develop and as conversion processes are defined.	Runs risk of needing redesign as markets change.

CONCLUSION

Mechanical separation can remove some materials from the waste stream but valuable products still remain to be reclaimed. Materials removal and size reduction will make landfill operation easier. Production of RDF for use in existing facilities is the most economical alternative but currently has a very limited market. Introduction of coal-fired facilities or new facilities with ash-handling capabilities are needed to make the production of RDF an attractive alternative on a large scale.

METHOD: Direct Combustion

The energy in wastes may be recovered by directly firing all or part of the wastes independently or with fossil fuels (co-combustion). Raw refuse can be fired in boilers designed for that purpose. Refuse-Derived Fuel (RDF) produced by shredding and air classification can be burned in boilers with ash handling capabilities such as those fueled with coal or wood waste.

	PRO	CON
ECONOMIC	Minimal cost for energy conversion if existing boilers or cement kilns are available ($4-7 per ton net costs). Production of steam could have large potential market (yet to be documented).	Usage in California requires new or extensively modified boilers. Competes with low-cost coal if boiler has ash-handling capability. Steam quality is lower than optimum for electrical power generation.
ENVIRONMENTAL	Landfill requirement reduced 70-90 percent, depending on process. Energy recovered is greater than processing requirements. Could supplement use of increasingly scarce fossil fuels.	Air emissions are still under investigation but system may have more difficulty with air quality impact regulations than with emission standards. Best management of residues under development.
TECHNOLOGICAL	Well developed in Europe and being demonstrated in the United States. Many small sized systems have been installed in Eastern United States. Steam recovery equipment is similar to proven solid fuel fired boilers using wood waste and coal.	The ability to control air emissions in accordance with California standards is a problem that is expected to be controllable but probably at considerable expense. Use in cement kilns adequately demonstrated but site specific and expensive at best.
IMPLEMENTABILITY	Steam energy source welcomed by industry.	Air pollution regulations are constantly being tightened. Requires assured supplies of waste.

CONCLUSION

Direct combustion is attractive from an economical point of view. However, severe implementation problems exist due to environmental pollution controls. Further evaluation is required in terms of capital and operating costs, corrosion hazards, reliability, residue, and environmental impacts.

METHOD: Pyrolysis

The destructive distillation of organic wastes in an oxygen deficient atmosphere is called pyrolysis. Two full scale systems (200 TPD) have been built and operated. One system used pure oxygen and produced a 370 BTU/SCF gas that can be transported but is not being actively marketed at this time. The other system uses preheated air and produces a 100 BTU/SCF gas that is not transportable and is used directly in a boiler. Smaller systems have been developed and operated with some success, but there is no commercialization at this time. Gas production appears the simplest and most likely development and is discussed below.

	PRO	CON
ECONOMIC	There is a large demand for the gas produced since it can be substituted for natural gas in industry with minimum modification. The gas produced may possibly be converted into high value hydrogen, methanol, methane, or ammonia (some are readily transported and all are derived almost exclusively from natural gas). Has the least net cost of all options examined when implemented in large scale and used for high value chemical feedstock products. Can supplement costly fossil fuels.	Capital intensity plus high operating costs make this an expensive energy option. Market analysis for high value products is not complete due to complexity. The gas is not economically storable. Lower cost systems may evolve, especially from coal gasification technology.
ENVIRONMENTAL	No major air pollution problems expected. Further testing is planned. Reduces volume of landfill requirements by 80-95 percent. Slagging system produces totally inert residue. Energy recovered is greater than processing requirements.	System waste water discharges requires extensive treatment. Gas produced is toxic and unsuitable for domestic use. Conversion efficiency is lower than direct combustion.
TECHNOLOGICAL	Combustion of gas (such as boilers) is state-of-the-art; conversion to chemicals may have unquantified development.	Conversion of the gas to high value products has not been demonstrated. Use of the system in a large scale operation has not been demonstrated.
IMPLEMENTABILITY	The high marketable products may attract financing. Market for gas is available. Equitable distribution of benefits is achieved by conserving natural gas for residential use.	Capital intensity and high operating cost mandates assured waste flow and product utilization. Requires large systems for economy and large quantities of dilution water for sewage treatment.

CONCLUSION

Pyrolysis appears to be the best potential alternative environmentally, and may become economically competitive with direct combustion as fuel prices and availability change. However, limited knowledge of present markets requires further analysis to verify the economic viability of producing the high value products and to determine an optimum product mix.

CALIFORNIA STATE RESOURCE AGENGY
MATERIALS FOR CLASSROOM TEACHERS

FOR USE IN TEACHING ABOUT
THE NATURAL ENVIRONMENT

Title: **Be Careful with Our Stately Treasures**
Description: A colorful poster showing each state's tree (limited printing).
Topic: Plants
Grade Level: 4-6
Agency: State Department of Forestry

Title: **Don't Join the Bucket Brigade, Leave Tide Pool Life Alone!**
Description: Poster; good for elementary and adult.
Topic: Ocean life
Grade Level: K-12
Agency: State Department of Fish and Game and the University of California Sea Grant Program

Title: **Endangered Wildlife of California**
Description: A timely booklet, well illustrated, describing endangered wildlife in California. It also lists rare and extinct species in California as well as a federal list of California endangered species.
Topic: Endangered species
Grade Level: K-12
Agency: State Department of Fish and Game

Title: **Fish, Wildlife, and Plant Species in California Designated Endangered or Rare**
Description: A listing of species rare or endangered in California.
Topic: Endangered species
Grade Level: 6-12
Agency: State Department of Fish and Game

Title: **Geology of Placer Deposits**
Description: A booklet detailing methods and techniques which can be useful in discovering gold-bearing placer deposits.
Topic: Geology
Grade Level: 10-12
Agency: State Department of Conservation

Title: **Marine Mammals of California**
Description: This booklet begins with a comprehensive description of the various modifications of marine animals and of the Order Letacea. Whaling and whale conservation, and the Marine Mammal Protection Act are also explained. The bulk of the publication illustrates and describes 34 of the marine mammals seen or identified near California.
Topic: Marine mammals
Grade Level: 6-12
Agency: State Department of Fish and Game and the University of California Sea Grant Program

Title: **Species Booklets**
Description: A series of 12 booklets offer information on many California fish and game species as well as nongame species. All have photographs and/or drawings identifying species. Descriptions of habitat, natural history, and distribution are also included.
Topic: Wildlife
Grade Level: 4-12
Agency: State Department of Fish and Game

Title: **The California Gray Whale**

Description: A brochure wit[h] excellent color photographs. Content covers biology of the gray whale, the migration, endangered status, and guidelines for whale watching.

Topic: Gray whale

Grade Level: 4-12

Agency: State Department of Fish and Game

Title: **Thanks to You We Still Have a Home**

Description: A colorful poster showing a variety of birds on vegetation representative of their environment (limited printing).

Topic: Animals/birds

Grade Level: K-6

Agency: State Department of Forestry

Title: **The Plants and Animals of Folsom Lake**

Description: A detailed guide to the diverse natural communities surroundig Folsom Lake State Recreational area.

Topic: Plants and animals

Grade Level: 10-12

Agency: State Department of Parks and Recreation

Title: **Wildlife Leaflets**

Description: Excellent one-page leaflets, each dealing with a single species of wildlife. Almost all familiar vertebrates are described.

Topic: Wildlife

Grade Level: 4-12

Agency: State Department of Fish and Game

Title: **Wildlife—The Environmental Barometer**

Description: A pamphlet detailing the importance of a healthy environment for wildlife and the potential harm of man-made cha[n]ges. Details harmful changes caused by man which may affect all of life, including man. "By saving wildlife man may save himself."

Topic: Wildlife

Grade Level: 4-12

Agency: State Department of Fish and Game

FOR USE IN TEACHING ABOUT THE BUILT ENVIRONMENT

Title: **A Description of the Set of Minerals and Rocks Furnished to California Schools by the California Division of Mines and Geology**

Description: A pamphlet filled with photographs and excellent chemical descriptions of minerals as well as a discussion of their economic worth and where they can be found in California.

Topic: Geology

Grade Level: 4-12

Agency: State Department of Conservation

Title: **Simplified Geologic Map of California**

Description: A postcard to commemorate the state centennial. Color coded to indicate age and rock type.

Topic: Geology

Grade Level: 4-12

Agency: State Department of Conservation

FOR USE IN TEACHING ABOUT SOCIAL INSTITUTIONS AND DECISION MAKING

Title: **Adventures in Public Transit**
Description: The learning activities are geared to Orange County but the format could be used elsewhere. The activities are approached as a "magic window experience" with firsthand observations to see, do, record, evaluate, and value.
Topic: Transportation
Grade Level: 6-8
Agency: State Department of Transportation

Title: **Checklist for You and the Environment**
Description: This brochure sets forth simple, everyday methods by which all Californians can reduce waste.
Topic: Waste reduction
Grade Level: 7-12
Agency: Solid Waste Management Board

Title: **Closing the Loop***
Description: This filmstrip describes the "hows" and "whys" of recycling.
Topic: Recycling
Grade Level: 7-12
Agency: Solid Waste Management Board

Title: **Composting**
Description: This slide show describes the process which diverts organic wastes from landfills and yields a rich soil amendment.
Topic: Composting
Grade Level: 7-12
Agency: Solid Waste Management Board

*Filmstrips also available as slide shows

Title: **The Davis Experience**
Description: A reprint from *Solar Age* (May 1978) describing the Davis energy study, their energy building code, and city planning strategies that maximize the use of solar energy.
Topic: Solar energy
Grade Level: 10-12
Agency: California Energy Commission

Title: **Estimating Utilities' Prices for Power Purchases from Alternative Energy Resources**
Description: A technical report that estimates the future costs of conventional energy resources so that cost comparisons with renewable and decentralized energy resources can be made in a more economically competitive manner. The information presented is an interesting case study of the role of the economic forecasting in present energy investment decisions. Includes data on California's electricity supply by fuel type and estimated costs of generating electricity with a variety of fuel types.
Topic: Energy
Grade Level: 10-12
Agency: California Energy Commission

Title: **Fact Sheets** (single items available for reproduction)
Description: A series of information bulletins covering a wide range of solid waste management topics: waste reduction, oil recyling, recycling, composting, the Solid Waste Management Board, waste to energy, glossary of solid waste management terms, citizen action for a waste-efficient California.
Topic: Waste management
Grade Level: 10-12
Agency: Solid Waste Management Board

Title: **The Garbage Crisis** (teacher background information)
Description: This brochure gives overview of the Solid Waste Management Board's activities statewide for 1980.
Topic: Waste management
Grade Level: 7-12
Agency: Solid Waste Management Board

Title: **Great American Wild Waste Show**
Description: Videotaped vaudeville performance by the Twelfth Night Repertory Company. Teaches four "R's" of solid waste management—reduce, reuse, recycle, recover.
Topic: Waste management
Grade Level: 7-12
Agency: Solid Waste Management Board

Title: **Industry Recycles:***
Description: This filmstrip describes current methods of recycling employed within various California industries.
Topic: Recycling
Grade Level: 7-12
Agency: Solid Waste Management Board

Title: **Joint Investigation by the California Energy Commission and the California Public Utilities Commission into the Availability and Potential Use of Solar Energy in California**
Description: A technical report that outlines the desirability of using solar energy for domestic water heating and passive space heating. Useful as a benchmark in studying the history of solar-related legislation in California. Recommendations for incentives utilities can use to motivate their customers to use solar energy are outlined. This publication can be used as a checklist of the progress made by the utilities in carrying out the recommendations listed.
Topic: Energy
Grade Level: 10-12
Agency: California Energy Commission

Title: **Passive Solar Design—Here and Now**
Description: Details and pictures various architectural designs which promote the collection, storage, and use of solar energy. Explores historical ways passive solar energy was used by the Greeks and Romans, the Mesa Verde Indians, and the residents of New England. Good discussion of the various ways that heat moves. Illustrates the effectiveness of passive systems and the importance of energy conservation.
Topic: Solar energy
Grade Level: 6-12
Agency: California Energy Commission

Title: **Salvaging Demolition Waste**
Description: This slide-show details innovative reuse and recycling of construction and demolition debris.
Topic: Salvaging
Grade Level: 6-12
Agency: Solid Waste Management Board

Title: **Saving Energy at Home—It's Your Money**
Description: Pamphlet illustrating how energy can be conserved at home.
Topic: Energy conservation
Grade Level: 6-12
Agency: California Energy Commission

*Filmstrips also available as slide shows

Title: **Solar Water Heaters in California 1891-1930**
Description: A magazine-type publication describing the use of solar energy to heat water. The technology is not as new as some people imagine.
Topic: Solar energy
Grade Level: 6-12
Agency: California Energy Commission

Title: **Solid Waste Management Resource Persons** (for large assembly presentations)
Description: Speakers available for presentations on variety of solid waste management topics: State Solid Waste Management Board, duties and functions; California's garbage crisis, controlling litter, waste reduction, resource recovery, recycling, salvaging and demolition wastes, and composting.
Topic: Waste management
Grade Level: 7-12
Agency: Solid Waste Management Board

Title: **Solid Waste Posters**
Description: Set of seven colorful posters depicting the good, bad, hilarious and silly ways in which we operate and simple "do-able" ways for us to change for the better: "Great Garbage Machine," "Technology!" "Why Recycle?" "Buyer Be-Aware!" "Recycling Is for Everyone!" "Running Out/Running Over!" "Garbage Is What You Throw Away!"
Topic: Waste management
Grade Level: 7-12
Agency: Solid Waste Management Board

Title: **State Solid Waste Management Board**
Description: This slide show gives an overview of California's Solid Waste Management Board membership, history, and functions.
Topic: Waste management
Grade Level: 7-12
Agency: Solid Waste Management Board

Title: **Transportation Alternatives—Student Handbook**
Description: A booklet which presents the modes of transportation. It can be used at home to do a self-transportation survey along with family involvement.
Topic: Transportation
Grade Level: 3-7
Agency: State Department of Transportation

Title: **Trash Monster**
Description: Interdisciplinary, two-week environmental education unit. Teaches students resource conservation skills. Complete sets of materials and procedures provided.
Topic: Waste management
Grade Level: 5-7
Agency: Solid Waste Management Board

Title: **Waste Reduction—A Consumer Action**
Description: This slide show is an examination of consumption/throw-away habits and simple, everyday measures to combat waste.
Topic: Waste reduction
Grade Level: 7-12
Agency: Solid Waste Management Board

Title: **Waste-To-Energy***
Description: This filmstrip describes the evolving technology of waste utilization as a resource to fill California's growing energy needs.
Topic: Energy
Grade Level: 7-12
Agency: Solid Waste Management Board

Title: **Wildlife—The Environmental Barometer**
Description: A brochure describing how wildlife can be used to assess the health of the environment.
Topic: Wildlife
Grade Level: 10-12
Agency: State Department of Fish and Game

Title: **Wizard of Waste**
Description: An interdisciplinary, two-week environmental education unit. Teaches students resource conservation skills. Complete sets of materials and procedures provided.
Topic: Waste management
Grade Level: 2-4
Agency: Solid Waste Management Board

*Filmstrips also available as slide shows

FOR USE IN TEACHING ABOUT RESOURCE MANAGEMENT

Title: **A Guide to the Urban Water Conservation Garden**
Description: This brochure gives valuable information for planting a variety of gardens (rock gardens, shrub beds, vegetable gardens, etc.) on one side; the other side is a poster of a model garden.
Topic: Water conservation
Grade Level: K-12
Agency: Department of Water Resources

Title: **An Introduction to the Energy Resources of California**
Description: A comprehensive "primer" on nonrenewable energy resources: oil gas, and geothermal. It includes a description of the geology of petroleum deposits and the various steps needed to produce oil from drilling to refining. A fold-out map of California shows the known petroleum and geothermal deposits.
Topic: Petroleum/Energy/Geology
Grade Level: 10-12
Agency: State Department of Conservation

Title: **A Pilot Water Conservation Program**
Description: A 1978 publication describing the Department of Water Resources public outreach program on water conservation during the drought. Specific water conserving devices and habits are outlined and the public's response to implementing water conservation strategies is discussed.
Topic: Water conservation
Grade Level: 7-12
Agency: State Department of Water Resources

Topic: **California Solar Information Packet**
Description: A pamphlet illustrating basic solar design principles, passive solar applications, and active solar systems.
Topic: Solar energy
Grade Level: 7-12
Agency: State Energy Commission

Title: **Decade of the Sun. Program for Maximum Implementation of Solar Energy through 1990**
Description: An excellent overview of California's Solar Program present and future, a review of the state-of-the-art of various solar technologies, potential electric energy savings with solar.
Topic: Energy/Solar
Grade Level: 10-12
Agency: California Energy Commission

Title: **Domestic Solar Water Heating—A Builder's Guide**
Description: A pamphlet describing the basic components of a solar domestic water heating system with illustrations.
Topic: Solar energy
Grade Level: 6-12
Agency: California Energy Commission

Title: **Energy Farming**
Description: A study of plant crops which could be used as a biomass for fuel. Economics of energy farming is discussed in conjunction with varied energy conversion routes and products from biomass.
Topic: Energy
Grade Level: 10-12
Agency: California Energy Commission

Title: **Environmental Impact Report for California Energy Commission Solar and Wind Programs**
Description: An excellent overview of the state's wind and solar programs describing the technologies, their impacts on air and water quality, and the potential of the resource for displacing nonrenewable energy resources.
Topic: Energy/Wind
Grade Level: 10-12
Agency: California Energy Commission

Title: **Excerpts from State Fire Laws Applicable to Forest Fire Prevention**
Description: A small pamphlet describing the fire permit process, techniques for fire hazard reduction, and penalties and liabilities related to behavior during forest fires.
Topic: Forest fires
Grade Level: 7-12
Agency: State Department of Forestry

Title: **Fire Hazard Reduction**
Description: A one-page handout diagramming the techniques for reducing fire hazards around a forest dwelling, as well as plans for building a chimney spark arrester.
Topic: Fire protection
Grade Level: 7-12
Agency: State Department of Forestry

Title: **Fireproof Your Forest Home**
Description: A small brochure with photographs showing how to clear the area around a structure to help prevent it from burning in case of a forest fire.
Topic: Fire prevention
Grade Level: 4-6
Agency: State Department of Forestry

Title: **Fire. Will Your Home be Next?**

Description: Pamphlet describing steps to take to reduce fire hazards to a structure by 70 percent.

Topic: Fire prevention

Grade Level: 7-12

Agency: State Depatment of Forestry

Title: **Handbook on California Natural Resources**

Description: An informational guide to the development and maintenance of programs in natural resource use and conservation. Good basic information on soil, water, minerals, air, plant, and animal life.

Topic: Natural resources

Grade Level: 8-12

Agency: State Department of Conservation

Title: **Hints for Water Conservation**

Description: An information bulletin outlining home water conservation strategies.

Topic: Water conservation

Grade: 4-6

Agency: State Department of Water Resources

Title: **Impact of Severe Drought in Marin County, California**

Description: A 1979 publication that outlines the effects of water shortage on residences, businesses, and livestock ranches. Contains many figures and tables of water use data. A good case study for secondary use.

Topic: Drought

Grade Level: 7-12

Agency: State Department of Water Resources

Title: **Joint Investigation by the California Energy Commission and the California Public Utilities Commission into the Availability and Potential Use of Solar Energy in California**

Description: A technical report that outlines the desirability of using solar energy for domestic water heating and passive space heating. Useful as a benchmark in studying the history of solar-related legislation in California. Recommendations for incentives utilities can use to motivate their customers to use solar energy are outlined. This publication can be used as a checklist of the progress made by the utilities in carrying out the recommendations listed.

Topic: Energy

Grade Level: 10-12

Agency: California Energy Commission

Title: **Save Energy**

Description: A survey of current activities in energy management of local, statewide, and national significance. Articles highlight CEES activities of local community groups, grant and utility programs, local government options, and state agencies working in energy. Each issue usually contains a policy piece and reproducible reference feature.

Topic: Energy management programs and policy

Grade Level: Designed for decision makers. Would be useful in high school as well.

Agency: California Energy Extension Service

Title: **Save Water**

Description: A graphically pleasing brochure outlining water conservation techniques. A good succinct introduction for use at all levels, including primary.

Topic: Water conservation

Grade Level: K-12

Agency: State Department of Water Resources

Title: **Solar Here and Now**

Description: A pamphlet detailing active and passive heating techniques.

Topic: Solar energy

Grade Level: 6-12

Agency: California Energy Commission

Title: **Solar Installers Training Manual**

Description: Over 200-page curriculum of domestic hot water systems, pool systems, and space heating systems. Manual is accurate, complete, and extremely practical and is currently used in over 15 training programs.

Topic: Training for solar installers

Grade Level: High school

Agency: SolarWork Institute, California Energy Extension Services (CEES)

Title: **Solar Pool Heating**

Description: A pamphlet illustrating how solar heats pool water and how the water cools off. Pool covers are discussed along with other ways heat may be conserved. Good information on collectors, collector tilt and sizing, controls, mounting the collectors; maintenance and installation are also covered.

Topic: Solar energy

Grade Level: 7-12

Agency: California Energy Commission

Title: **Synthetic Oil vs. Methanol as a Liquid Fuel Product from Waste Conversion Processes**

Description: A technical report describing the processes by which municipal, agricultural, and forestry wastes can be converted into ethanol or methanol, and a discussion of the ways ethanol and methanol can be used to substitute for gasoline, natural gas, or diesel oil in combustion turbines for generating electricity as fuel for automobiles and as a fuel for boilers.

Topic: Energy from municipal, agricultural, and forest wastes

Grade Level: 10-12

Agency: California Energy Commission

Title: **The LNG Decision in California: Reliability, Cost, Safety, and Siting**

Description: Good resource describing LNG world trade routes, facilities, and terminals with numerous charts and tables relating to LNG cost, safety, and siting.

Topic: Energy/LNG

Grade Level: 10-12

Agency: California Energy Commission

Title: **Urban Forestry**

Description: A four-page pamphlet dealing with planting trees in urban areas. Urban forestry projects are described which could be duplicated by a class.

Topic: Trees

Grade Level: K-12

Agency: State Department of Forestry

Title: **Water Conservation in California**

Description: A 1976 publication describing water uses in California. Water conservation strategies for residences, businesses, and agriculture are outlined. Many figures and tables are included.

Topic: Water

Grade Level: 7-12

Agency: State Department of Water Resources

Title:	**Water Pricing**
Description:	An information bulletin describing water pricing strategies that can encourage water conservation.
Topic:	Water conservation
Grade Level:	10-12
Agency:	State Department of Water Resources

Title:	**Water Saving Planting Ideas** (reprinted from *Sunset* magazine)
Description:	An informative article describing drought-tolerant or drought-resistant plants for California gardens.
Topic:	Water conservation
Grade Level:	7-12
Agency:	Department of Water Resource

Title:	**Wind-Electric Power, A Renewable Energy Resource for California**
Description:	An overview of the use of wind in California to generate electricity. Includes a map of high-wind areas in the state and a summary of the California wind program through 1978. (This can be updated with more current information from the ECE Wind Office.)
Topic:	Energy/Wind-Electricity
Grade Level:	10-12
Agency:	California Energy Commission

RESIDENT OUTDOOR EDUCATION

Resident outdoor education programs are based on three ingredients for effective learning: a specific body of content, firsthand experience, and personal identification with the affective goals of the program. As the name implies, outdoor education takes place outdoors in the natural environment. The setting is a laboratory where firsthand observations provide the examples that lead to discovering and confirming the scientific principles on which the program is based. Personal verification of facts, principles, and aesthetic appreciation is at the core of every learning experience. Since the environment is teacher and textbook, the group leader is free to act as a resource person and carry on a dialogue with students, exchanging observations and ideas, making generalizations based on multiple observations, and expressing the feelings and appreciation that a close study of the natural environment evokes.

Outdoor settings are generally crowded with interesting things to observe and think about. Students are easily involved with the content of the setting. This makes it possible for the leader to move easily from working with individuals, to small groups, or the total group. Independence and personal responsibility are emphasized in making observations, initiating dialogues, exchanging ideas, and assuming responsibility for learning.

The natural environment is an optimal setting for developing positive attitudes about the relationship of self to the environment. Examples of cause and effect relationships are available everywhere. There is immediate feedback on the consequences of human action on the environment. Within this context, students can develop a sense of personal responsibility in caring for the environment.

Recognition of the inherent beauty in an outdoor setting brings a richness to our lives that is beyond words. The multitude of living things—plants and animals—in the natural environment can be used to build a respect for the preciousness of life. The variety of forms living in harmony and for mutual benefit in a small area of the environment are representative of the principles that govern all of nature.

California public schools are fortunate to have access to a variety of resident outdoor school programs. Because these programs are an integral part of environmental education, a directory of city and county programs follows:

City and County Resident Outdoor Education Programs

Fresno County
Chuck Kaylor
Regional Learning Center
Route 3, Box 530
Sonora, CA 95370
(209) 532-3691

Glenn County
Ralph Herman
525 West Sycamore
Willows, CA 95988
(916) 934-7011

Humboldt County
Cheryl Christiansen
901 Myrtle Avenue
Eureka, CA 95501
(707) 445-7611

Kern County
Ben Bird
5801 Sundale Avenue
Bakersfield, CA 93309
(805) 834-3700

Lake County
Gerald DeFries
P.O. Box 457
Boonville, CA 95433

Los Angeles Unified
Durrell Maughan
3317 Beilevue Avenue
Los Angeles, CA 90026
(213) 625-6000

Los Angeles County
9300 East Imperial Hwy.
Downey, CA 90242
(213) 922-6334

Long Beach Unified
701 Locust Avenue
Long Beach, CA 90813
(213) 436-9931

Marin County
1111 Las Galinas Avenue
San Rafael, CA 94903
(415) 472-4110

Monterey County
J. P. Van Ettinger
P.O. Box 851
Salinas, CA 93901
(408) 424-0654

Orange County
P.O. Box 15029
Santa Ana, CA 95705
(714) 953-3900

Sacramento County
Glenn Davis
5600 Sly Park Road
Pollack Pines, CA 95726
(916) 366-2718

San Francisco City & County
Lynette Porteous
135 Van Ness Avenue
San Francisco, CA 94102
(415) 505-9000

San Joaquin County
22 East Weber Avenue
Stockton, CA 95202
(209) 944-2394

San Luis Obispo County
Jim Barlow
2156 Sierra Way
San Luis Obispo, CA 93401
(805) 544-3288

San Mateo County
Glendon McFate
333 Main Street
Redwood City, CA 94063
(415) 364-5600

Santa Barbara County
Paul Jillson
4400 Cathedral Oaks Road
Santa Barbara, CA 93111
(805) 964-4711

Santa Clara County
Carl Miescke
100 Skyport Drive
San Jose, CA 95110
(408) 299-2374

Santa Cruz County
Dr. Jeanne Hubert
701 Ocean Street
Santa Cruz, CA 95060
(408) 425-2001

Shasta County
Brian Swagerty
1644 Magnolia
Redding, CA 96002
(916) 244-4600

Siskiyou County
Larry Wehmeyer
609 Gold Street
Yreka, CA 96097
(916) 842-5751

Sutter County
Jack Murtha
463 Second Street
Yuba City, CA 95991
(916) 673-6110

Tulare County
James Vidak
County Civic Center
Visalia, CA 93277
(209) 733-6386